Vol. 11, No. 11
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Energy Research Abstracts

Abstracts 25263-26813

Office of Scientific & Technical Information
UNITED STATES DEPARTMENT OF ENERGY

CURRENT AWARENESS PUBLICATIONS ON ENERGY

To provide complete coverage of literature related to major Department programs, announcement publications that are comprehensive in their coverage of certain energy fields are issued regularly. All information in these publications, plus additional backup information, is included in the Energy Data Base of the Office of Scientific and Technical Information; all references are also available for machine searching via the on-line retrieval system, DOE/RECON, and the commercial on-line retrieval systems. Descriptions of these current awareness publications, which are supported either directly or indirectly by the DOE, appear below. Department of Energy components may receive the listed publications free from the Office of Scientific and Technical Information, U. S. Department of Energy, P. O. Box 62, Oak Ridge, TN 37831. Telephone (615) 576-1301; FTS 626-1301.

PUBLICATIONS OF THE OFFICE OF SCIENTIFIC AND TECHNICAL INFORMATION

Energy Abstracts for Policy Analysis (EAPA)

A monthly abstract journal devoted to the analysis of energy research, conservation, and policy. Scope and coverage are limited to substantive articles or reports and emphasize legislative, regulatory, and other legal aspects, as well as social, economic, and environmental impacts. *EAPA* is available from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The annual subscription price is $72.00 for domestic (North America) or $90.00 for foreign (outside North America) subscribers; a single issue is $5.00 or $6.25, respectively.

Energy Research Abstracts (ERA)

A comprehensive semimonthly abstract journal devoted to all areas of energy-related information produced by the Department of Energy, other U. S. government organizations, and foreign governments. *ERA* is available from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The annual subscription price for the 24 issues is $146.00 for domestic (North America) subscribers or $182.50 for foreign (outside North America) subscribers. A single issue is $14.00 or $17.50, respectively.

DOE Patents Available for Licensing (PAL)

DOE is prepared to grant exclusive or nonexclusive, revocable licenses under DOE-owned U. S. patents and patent applications; this semiannual publication provides abstracting and indexing coverage of this literature. *PAL* is available (use PB86-946800) from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161. The annual price is $18.00 for domestic (North America) or $36.00 for foreign (outside North America); a single issue is $9.00 or $18.00, respectively.

Energy Meetings (EM)

A monthly listing of conferences, symposia, workshops, etc., pertaining to DOE's programmatic interests. *EM* is available on subscription (use PB86-901500) from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161. The annual subscription price is $45.00 for domestic subscribers and $90.00 for subscribers outside the North American continent; a single issue is $5.00 and $10.00, respectively.

The following monthly update journals are available to the public on subscription from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161; use the identifying order number (PB- No.) when subscribing. The annual subscription price (12 issues plus cumulative index) is $85.00 for domestic (North America) and $170.00 for foreign (outside North America) subscribers; a single issue is $8.00 and $16.00, respectively.

Current Energy Patents (CEP)–**PB86-902800.** International patent literature, including patent applications, on any aspect of energy production, conservation, and utilization.

Energy and the Environment (EAE)–**PB86-914900.** Impacts of energy-related activities and radioactive and nonradioactive pollutants on the environment.

Fossil Energy Update (FEU)–**PB86-914600.** The exploration, development, processing, and use of fossil fuels.

Fusion Energy Update (CFU)–**PB86-915300.** Information on controlled thermonuclear fusion, including plasma and fuel research and power plant engineering and conceptual design studies.

Solar Energy Update (SEU)–**PB86-914500.** The utilization of solar energy, including biomass and tidal and wind power.

The following semimonthly bulletins are also available from the National Technical Information Service. The annual subscription rate for one volume (calendar) year (24 issues; no indexes) is $45.00 for domestic (North America) and $90.00 for foreign (outside North America) subscribers; use the identifying order number (PB- No.) when subscribing.

Acid Precipitation (APC)–**PB86-901000.** Acid precipitation, including effects and possible control measures.

Buildings Energy Conservation (BEC)–**PB86-900700.** Technology required for energy conservation in buildings of all types.

Coal-Based Synfuels (CBS)–**PB86-901400.** Conversion of coal into gaseous or liquid fuels.

Coal Combustion and Utilization (CCU)–**PB86-914400.** Coal combustion, including fluidized bed combustion, and direct utilization of coal for power generation, fuel cells, and MHD generators.

Coal Preparation and Pollution Control (CPC)–**PB86-900800.** Coal preparation and cleaning and reducing pollution from its direct combustion.

Direct Energy Conversion (DEC)–**PB86-946600.** Photovoltaics, magnetohydrodynamics, electrohydrodynamics, thermoelectrics, thermionics, and fuel cells.

Energy from Biomass (EFB)–**PB86-900600.** Biomass production, conversion, and utilization for energy.

Geothermal Energy Technology (GET)–**PB86-914700.** Exploration, development, and utilization of geothermal resources.

Heavy-Ion Reactions (HIR)–**PB86-900500.** Heavy-ion (A > 4) reactions.

Laser Research (LAR)–**PB86-901100.** Laser research and development, excluding applications.

Nuclear Fuel Cycle (NFC)–**PB86-913400.** Both front and back ends of the nuclear fuel cycle.

Nuclear Reactor Safety (NRS)–**PB86-913500.** Accident analysis, safety systems, radiation protection, decommissioning and dismantling, and security measures.

Radioactive Waste Management (RWM)–**PB86-902900.** Management aspects of transport and storage, waste processing, waste disposal, waste storage, radioactive effluents, and shipping containers.

Solar Thermal Energy Technology (STT)–**PB86-901200.** Research and development of efficient and reliable solar thermal conversion systems.

Transportation Energy Research (TER)–**PB86-900900.** Energy-efficient advanced automotive propulsion systems and transportation energy conservation.

Unconventional Petroleum (UCP)–**PB86-901300.** Secondary and tertiary recovery of petroleum and oil shales and tar sands.

INTERNATIONAL ENERGY PUBLICATIONS

The Office of Scientific and Technical Information (OSTI) cooperates in the publication of international abstract journals with the following: (1) International Atomic Energy Agency, International Nuclear Information System, Vienna, Austria, for *Atomindex;* (2) International Energy Agency, Biomass Conversion Technical Information Service, Dublin, Ireland, for *Biomass Abstracts;* and (3) International Energy Agency, IEA Coal Research, London, England, for *Coal Abstracts.* In each case, the cognizant foreign agency provides the non-U. S. information to OSTI for inclusion in the Energy Data Base; in turn, OSTI provides the U. S. information for input into the respective journal.

Atomindex

A semimonthly abstract journal providing worldwide coverage of information on nuclear science and technology. *Atomindex* is available by subscription from UNIPUB, 345 Park Avenue South, New York, NY 10010. The cost of an annual subscription, 24 semimonthly issues and semiannual and annual cumulative indexes, is $290.

Biomass Abstracts

A bimonthly abstract journal with comprehensive coverage of information on the conversion of biomass to energy. *Biomass Abstracts* is available free to DOE components and contractors from OSTI. Non-DOE organizations may obtain *Biomass Abstracts* from Biomass Conversion Technical Information Service, Institute for Industrial Research and Standards, Ballymun Road, Dublin 9, Ireland, for 42 IR pounds per year. Make checks payable to the Institute.

Coal Abstracts

A monthly abstract journal providing comprehensive worldwide coverage of information in the field of coal science and technology. *Coal Abstracts* is available to DOE components and contractors from OSTI. Non-DOE organizations may obtain *Coal Abstracts* from IEA Coal Research, Technical Information Service, 14-15 Lower Grosvenor Place, London SW1W 0EX, England, for 100 pounds sterling per year.

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ENERGY RESEARCH ABSTRACTS

ABOUT THE OFFICE OF SCIENTIFIC AND TECHNICAL INFORMATION

The Office of Scientific and Technical Information (OSTI) in Oak Ridge, Tennessee, has been the national center for scientific and technical information for the Department of Energy (DOE) and its predecessor agencies since 1946. In developing and managing DOE's technical information program, OSTI places under bibliographic control not only DOE-originated information but also worldwide literature on scientific and technical advances in the energy field and announces the source and availability of this information. Whereas the literature of science is emphasized, coverage is extended to DOE programmatic, socioeconomic, environmental, legislative/regulatory, energy analysis, and policy-related areas. To accomplish this mission, OSTI builds and maintains computerized energy-information data bases and disseminates this information via computerized retrieval systems and announcement publications such as abstracting journals, bibliographies, and update journals. Direct access to OSTI's most comprehensive data base, the Energy Data Base, is available to the public through commercial on-line bibliographic retrieval systems. The Energy Data Base and many of OSTI's energy-related data bases are available to DOE offices and contractors and to other government agencies via DOE/RECON, the Department's on-line information retrieval system. The Office of Scientific and Technical Information has developed and maintains systems to record and communicate energy-related research-in-progress information, to maintain a register of DOE public communications publications, to track research report deliverables from DOE contractors, and to test and make available DOE-funded computer software programs with scientific and management applications; OSTI also serves as adviser for special publication needs of the Department. To effectively manage DOE's technical information resources, OSTI's program is one of continual development and evaluation of new information products, systems, and technologies.

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ABOUT *ENERGY RESEARCH ABSTRACTS*

Energy Research Abstracts (ERA) provides abstracting and indexing coverage of all scientific and technical reports, journal articles, conference papers and proceedings, books, patents, theses, and monographs originated by the U. S. Department of Energy, its laboratories, energy centers and contractors. *ERA* also covers other energy information prepared *in report form* by federal and state government organizations, foreign governments, and domestic and foreign universities and research organizations. The user should remain aware that *ERA* coverage of non-report literature is limited to that generated by Department of Energy activity.

ERA is comprehensive in its subject scope, encompassing the DOE's research, development, demonstration, and technological programs resulting from its broad charter for energy sources, supplies, safety, environmental impacts, and regulation.

ERA is available on an exchange basis to universities, research institutions, industrial firms, and publishers of scientific information. Inquiries should be directed to the Office of Scientific and Technical Information, P. O. Box 62, Oak Ridge, TN 37831.

ERA is available to the public on a subscription basis from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The subscription rate for the 24 semimonthly issues is $146.00 for domestic subscribers and $182.50 for foreign subscribers. A single issue costs $14.00 (domestic) or $17.50 (foreign). The cumulative indexes will be available in printed form from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402, and in microfiche form from the National Technical Information Service, U. S. Department of Commerce, Springfield, VA 22161, and from Engineered Systems, P. O. Box 866, Oak Ridge, TN 37831.

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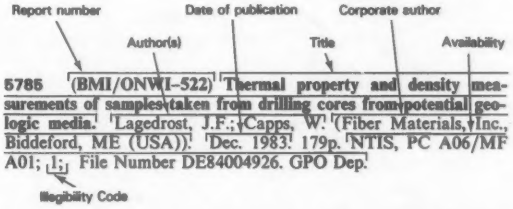
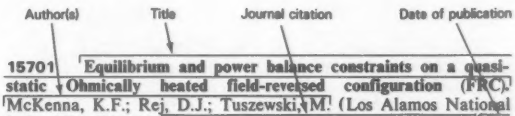
ABSTRACTS IN *ENERGY RESEARCH ABSTRACTS*

The principal elements of abstract entries for a typical research and development report and a typical technical journal article are illustrated below.



5785 (BMI/ONWI-522) **Thermal property and density measurements of samples taken from drilling cores from potential geologic media.** Lagedrost, J.F.; Capps, W. (Fiber Materials, Inc., Biddeford, ME (USA)). Dec. 1983. 179p. NTIS, PC A06/MF A01; 1; File Number DE84004926. GPO Dep.

Abstract: Density, steady-state conductivity, enthalpy, specific heat, heat capacity, thermal diffusivity and linear thermal expansion were measured on 59 materials from core drill samples of several geologic media, including rock salt, basalt, and other associated rocks from 7 potential sites for nuclear waste isolation. The measurements were conducted from or near to room temperature up to 500°C, or to lower temperatures if limited by specimen cracking or fracturing. Ample documentation establishes the reliability of the property measurement methods and the accuracy of the results.



15701 **Equilibrium and power balance constraints on a quasi-static, Ohmically heated field-reversed configuration (FRC).** McKenna, K.F.; Rej, D.J.; Tuszewski, M. (Los Alamos National Lab., NM (USA)). *Nuclear Fusion;* **23:** No. 10, 1319-1325 (Oct 1983).

Abstract: Zero-dimensional power balance calculations are performed for a quasi-static, purely Ohmically heated field-reversed configuration. Without compression, the constraint imposed by radial pressure balance limits the power input. Estimates of the energy loss from impurity line radiation as well as from classical and anomalous transport are given. Effects of cold puff gas injection are also investigated.

INDEXES TO *ENERGY RESEARCH ABSTRACTS*

Five indexes are provided for approaching the contents of each issue of *Energy Research Abstracts (ERA).* Each index is preceded by an introduction that details the organization of the index and the principles by which it was compiled. The reader is referred to these introductions for information not found in the index examples that follow.

• Corporate Author Index

Technical report literature is indexed using the name of the organization or institution responsible for the issuance of the report.

5785 (BMI/ONWI-522) **Thermal property and density measurements of samples taken from drilling cores from potential geologic media.** Lagedrost, J.F.; Capps, W. **(Fiber Materials, Inc., Biddeford, ME (USA)).** Dec. 1983. 179p. NTIS File Number DE84004926. GPO Dep.

is indexed as:

Fiber Materials, Inc., Biddeford, ME (USA)

• Personal Author Index

Each author's name is indexed in the form appearing on the document abstracted, with the exception that given names are reduced to initials:

Capps, W., *See* Lagedrost, J. F.
Lagedrost, J.F., Thermal property and density measurements of samples taken from drilling cores from potential geologic media, 9:5785 (R;US)
McKenna, K.F., Equilibrium and power balance constraints on a quasi-static Ohmically heated field-reversed configuration (FRC), 9:15701 (J;US)
Rej, D.J., *See* McKenna, K.F.
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• Subject Index

The subject index consisting of entries naming specific materials, objects, and processes is arranged alphabetically. Document titles, informative phrases, or both specific to these entries are arranged alphabetically under the entries.

SALT DEPOSITS
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• Contract Number Index

DOE technical report literature is indexed using contract numbers. This index contains the contract number with corresponding abstract and report numbers.

AC06-76RL01830 **Fiber Materials, Inc., Biddeford, ME (USA)** 9:5785 BMI/ONWI-522

• Report Number Index

Technical report literature is also indexed using report numbers. This index includes information on where individual reports may be obtained. Patents and conference papers are indexed here as a matter of convenience. When a report is supplied under a File Number, that number is included in the availability statement. A file number–report number correlation is included for convenience.

BMI/ONWI-522 9:5785 NTIS, PC A09/MF A01. File Number DE84004926, Distribution Category MN-70

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CEA Centre d'Etudes de Saclay
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Energie, Physik, Mathematik GmbH
Karlsruhe, Federal Republic of Germany

IEA Biomass Conversion Service
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Communication concerning the editorial policy and content of *Energy Research Abstracts* should be addressed to the Editor, *Energy Research Abstracts,* Office of Scientific and Technical Information, P. O. Box 62, Oak Ridge, TN 37831.

SUBJECT CONTENTS (NUMERICAL LISTING)

Six-digit subject category numbers are used in the storage, retrieval, and manipulation of bibliographic information entered into DOE's computerized bibliographic information system. The six-digit category numbers are utilized as if they were three pairs of two-digit numbers, the first two pairs being used to arrange the abstract content of *Energy Research Abstracts*. The following listing includes the totality of the 39 first-level and 293 second-level subject categories used. Because each issue of *ERA* announces only those documents becoming available during a semi-monthly period, some subject categories may not be represented in every issue. The complete subject category scheme with scope definitions and limitations is available as DOE/TIC-4584-R6 from NTIS for $9.50.

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ENERGY RESEARCH ABSTRACTS

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REFER ALSO TO CITATION(S) 25285, 25295, 25295, 25297, 25306, 25307, 25315, 25327, 25451, 25530

25263 (DOE/FE/55014—T17) Great Plains Coal Gasification project. Quarterly technical progress report, third quarter 1985. (ANG Coal Gasification Co., Beulah, ND (USA)). 31 Oct 1985. Contract FM02-82FE55014. 151p. NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE86008801.

The operations of the Great Plains Gasification Plant are reported for the third quarter of 1985. Contents include the following: (1) lignite coal production; (2) SNG production; (3) SNG gas quality; (4) by-products production and inventories; (5) on-stream factors; (6) raw material, product and by-product consumption and energy consumption for plant operations; (7) plant modifications-1985; (8) plant maintenance; (9) safety; (10) industrial hygiene; (11) medical services; (12) environmental; and (13) quality assurance/quality control activities.

25264 (DOE/FE/55014—T18) Great Plains Coal Gasification project. Quarterly technical progress report fourth quarter, 1985. (ANG Coal Gasification Co., Beulah, ND (USA)). 31 Jan 1986. Contract FM02-82FE55014. 184p. NTIS, PC A09/MF A01; 1; GPO Dep. File Number DE86008802.

The operations of the Great Plains Gasification plant are reported for the fourth quarter of 1985. Contents include the following: (1) lignite coal production; (2) SNG production; (3) SNG gas quality; (4) by-products production and inventories; (5) on-stream factors; (6) raw material, product and by-product consumption and energy consumption for plant operations; (7) plant modifications - 1985; (8) plant maintenance; (9) safety; (10) industrial hygiene; (11) medical service; (12) environmental; and (13) quality assurance/quality control activities.

25265 (DOE/MC/21108—5) Management of coal waste by energy recovery: mild gasification/flash pyrolysis of coal preparation wastes. Quarterly report, October-December 1985. Gillespie, B.L. (UCC Research Corp., Bristol, VA (USA)). Feb 1986. Contract AC21-84MC21108. 24p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86006896.

Feedstock characterization is now complete. Two of the refuse feedstocks, the bituminous coal feedstock and the subbituminous coal feedstock, were obtained and prepared for use in the mild gasification unit (MGU). Construction continued on the mild gasification unit and is estimated to be 95% complete. Most of the major equipment for the MGU is in place and operational. The vacuum pump and hydraulic limit switches are the remaining items to be installed on the unit. The final test plan was prepared. The test plan includes 24 tests, six with subbituminous coal, seven with coal preparation waste, and eleven with bituminous coal. The tests are designed to measure the effects of feedstock, particle size, temperature, residence time, sweep gas, and solid additives on unit performance, product quantity, and product quality. The MGU has performed well during five tests with only minor problems dealing with condensation of the hydrocarbon gases.

25266 (DOE/METC—85/4014) Evaluation of the WEN II and DENN-1D steady-state, fixed-bed gasifier models. Stefano, J.M. (USDOE Morgantown Energy Technology Center, WV). May 1985. 74p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE86001019.

In this study, the steady-state, one-dimensional WEN II and DENN-1D fixed-bed gasifier models were compared theoretically and with experimental data to determine their advantages and disadvantages in predicting the operating characteristics of fixed-bed gasification. Initially, the models were compared in terms of their major assumptions, limitations, and unique characteristics. Many of the major assumptions in the models are similar. The main differences occur in the way the models handle drying of coal, predict devolatilization, and represent the kinetics of gasification and combustion reactions. To test the predictive capabilities of the model, each was run with Pittsburgh No. 8 and Illinois No. 6 bituminous coals, Montana Rosebud subbituminous coal, and North Dakota Indianhead lignite. Both air- and oxygen-blow cases were tested as well as both dry-ash and slagging operation. The dry-ash cases utilized data from the METC, General Electric (GE), and British Gas Corporation (BGC)/Lurgi dry-ash gasifiers. Data from the BGC/Lurgi slagging gasifier and the former Grand Forks Energy Technology Center (GFETC) gasifier were used for the slagging gasification cases. In all, 12 cases were tested, 10 dry-ash and 2 slagging cases. Results are discussed. 14 refs., 38 figs., 14 tabs.

25267 (DOE/METC—86/4057) Model for coal ash agglomeration based on two-particle dynamics. Moseley, J.L.; O'Brien, T.J. (USDOE Morgantown Energy Technology Center, WV). Jan 1986. 118p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE86001061.

The agglomeration of coal and coal ash in fluidized-bed gasifiers (FBG's) is of great interest in coal conversion. However, only limited work has been done to develop analytical models in order to understand ash agglomeration in FBG's. This paper focuses on two-particle collision dynamics, which is then used to develop a criterion for the agglutination of the two particles. The main assumption of this mechanism is that the binding force can be modeled as "piecewise" conservative. This makes it possible to compute the maximum energy that can be dissipated by the system. Comparison of this quantity with the initial kinetic energy provides the agglutination criteria. A specific version of this model is obtained by making specific choices for the contact force and the binding force. An analytic formula for the critical velocity, the relative collision velocity below which agglutination takes place, is obtained for head-on collisions; a numerical technique is developed for collisions which are not head-on. A process change which increases the critical velocity increases the likelihood of agglutination of particles with random relative velocities. To examine the critical velocity as a function of temperature, the model requires correlations for the shear modulus and surface adhesiveness coefficient of the particles. Although these correlations are derived from limited experimental information, they lead to reasonable results and agreement with existing experimental data on agglomeration and defluidization. By considering the agglutination of particles of average size and temperature, a measure of the agglomeration tendency of a FBG can be obtained. Finally, the sensitivity of the model to system parameters is also investigated and an assessment of needed additional work is made. 35 refs., 12 figs.

25268 (DOE/PC/50799—T9) Enhanced coal liquefaction by hydropyrolysis in supercritical fluids. Final technical report. Paulaitis, M.E.; Klein, M.T.; Stiles, A.B. (Delaware Univ., Newark (USA). Dept. of Chemical Engineering). [nd]. Contract FG22-82PC50799. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86008357.

This research program involved a fundamental investigation of a novel coal liquefaction process that combines pyrolysis, supercritical-fluid solvent extraction, and in situ hydrogen generation through catalytic dissociation of methanol. The experimental work consisted of determining: (1) coal pyrolysis reaction pathways, ki-

netics and mechanisms, and the identify and structure of reaction intermediates; (2) solubilities of coal-derived species in supercritical water and methanol; and (3) reaction pathways involved in the generation of hydrogen by catalytic dissociation of methanol to carbon monoxide and hydrogen, and through the shift of carbon monoxide. Both model coal compounds and actual coals were studied. 13 refs.

25269 **(DOE/PC/72262—T1) Model database management system for numerical information on coal liquefaction technology. Final report.** Panvelker, S. (Schneider Consulting Engineers, Bridgeville, PA (USA)). Mar 1986. Contract AC22-84PC72262. 188p. NTIS, PC A09/MF A01; 1; GPO Dep. File Number DE86008254.

Pittsburgh Energy Technology Center maintains a vast amount of information on coal liquefaction technology presently structured into a data base in bibliographic/textual terms. The utility of this data base would be considerably enhanced if it would allow for search and retrieval of numerical data. The objective of this project was to develop a model data base for search and retrieval of coal liquefaction technology information based on user specified numerical and non-numerical criteria. The design of the Model Data Base was guided by two principles: First, a data base should serve the needs of as many users as possible. The user of a technical data base may be interested in any particular aspect of technology, e.g.; research and development, scientific and engineering analysis of numerical data, process simulation, plant operation, economic evaluation or policy analysis. To accommodate this diversity of users, it was decided to design the data base in a modular manner, creating a separate module for each aspect of technology. This design will make the database system not only flexible for future modifications but also allow its linkage with other high quality data bases. The second major requirement was to define the numerical data needs of the users. Since this project was time-constrained and since a variety of data could be envisioned as high quality and high utility data to satisfy diverse users, only a few key aspects of the direct coal liquefaction technology were investigated. The model database includes four modules: Bibliography Module (which is connecting link between all other modules); Liquefaction Module (feed materials and liquefaction parameters); Property Module (properties of various liquefaction products); and the Correlation Module.

25270 **(EPRI-AP—4472) Processing of coal with microorganisms. Final report.** Olson, G.J.; Brinckman, F.E.; Iverson, W.P. (National Bureau of Standards, Washington, DC (USA)). Mar 1986. 42p. Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303. File Number TI86920227.

A computer-assisted survey and evaluation of the international literature on microbial transformations of coal and relevant organic compounds was performed to identify candidate microorganisms and biological processes potentially applicable to coal bioprocessing. The vast majority of the literature on coal bioprocessing deals with desulfurization via pyrite removal, and some bioprocessing schemes have been proposed. Reports on organic sulfur and metals removal from coal have recently appeared. As yet unevaluated are systems for removal of other elements from coal such as oxygen and nitrogen. However, model substrates resembling certain important O and N functional groups in coal are degraded by microorganisms. These microorganisms could potentially be useful in coal bioprocessing. Our laboratory results suggest that a strain of Bacillus, capable of vanillic acid decarboxylation, may remove carboxyl groups from coal. We were not able to confirm literature reports on organic S removal from coal by Sulfolobus, or on coal liquefaction by certain fungi. 90 refs., 4 figs., 3 tabs.

25271 **(GAO/RCED—86-36) Synthetic fuels. Status of the Great Plains Coal Gasification Project, August 1, 1985.** Bowsher, C.A. (General Accounting Office, Washington, DC (USA). Office of the Comptroller General). Dec 1985. 24p. General Accounting Office, Box 6015, Gaithersburg, MD 20877. File Number TI86901165.

Report to the Congress of the United States.

In December 1984, the Great Plains Gasification Associates had essentially finished constructing the nation's first commercial-scale coal gasification plant. As of July 31, 1985, Great Plains had contributed about $537 million in equity to the project and had borrowed $1.54 billion against a federal load guarantee made available by the Department of Energy (DOE). Since 1984 the project has faced deteriorating financial projections in the wake of declining energy prices. This is GAO's eighth semiannual report on Great Plains and covers the project's progress from January through August 1, 1985. GAO's objectives were to report on (1) the status of Great Plains' attempt to obtain additional federal financial assistance and (2) the status of the project's operational startup activities as of August 1, 1985. The Department of Energy Act of 1978 requires GAO to report on the status of the loan guarantee. Even though the Synthetic Fuels Corporation approved price guarantees in principle for Great Plains, DOE announced, on July 30, 1985, that it would not agree to restructuring its guaranteed loan. DOE rejected the proposed agreement, saying that it would not assure long-term plant operation at a reasonable cost to the taxpayers. The Great Plains sponsors then terminated their participation in the project on August 1, 1985, and defaulted on the $1.54 billion DOE-guaranteed loan. DOE directed the project administrator, ANG Coal Gasification Company, to continue plant operations pending a DOE decision about the project's future. DOE is assessing options including operating, leasing, selling, shutting down, mothballing, and scrapping the plant.

25272 **(PB—86-157427/XAB) Evaluation of coal conversion catalysts. Annual report, January-December 1982.** Lee, A.L. (Institute of Gas Technology, Chicago, IL (USA)). Jun 1983. 36p. (REPT—30523). NTIS, PC A03/MF A01.

The first-cut design data acquisition for the Direct Methanation Process (a catalytic process based on the reaction of equimolar concentrations of carbon monoxide and hydrogen to form methane and carbon dioxide in the presence of high concentrations of sulfur compounds) using a Westinghouse-type raw gas and that using a dry-bottom Lurgi-type raw gas were completed. The GRI-C-600 series catalyst, developed by Catalysis Research Corporation, was evaluated with the first-stage and the third-stage Lurgi-type raw gases, and the standard gas. The GRI-C-600 series catalyst showed an average of 34% higher conversion than the GRI-C-500 series catalyst. A microprocessor-controlled reactor system was modified to include two parallel reactors so that life test of two catalysts can be conducted simultaneously. The COS hydrolysis/hydrogenation reactions at conditions of the shift converter of a Westinghouse base case were determined.

25273 **(PB—86-157435/XAB) Evaluation of coal-conversion catalysts. Annual report, January-December 1984.** Lee, A.L. (Institute of Gas Technology, Chicago, IL (USA)). Jan 1985. 27p. (REPT—30523). NTIS, PC A03/MF A01.

A novel family of sulfur-resistant, low-carbon fouling hydrogenation catalysts were discovered by Catalysis Research Corporation for GRI. These catalysts promote the direct methanation reaction in which equal molar concentrations of H_2 and CO react to produce CH_4 and CO_2. IGT evaluated these catalysts. The work performed during 1984 includes the following: Concurrent life tests of the GRI-C-500 and GRI-C-600 catalysts were completed; The steam reforming of a sulfur-containing natural gas using the GRI-C-318 catalyst was conducted; The evaluation of the GRI-C-700A and GRI-C-700B catalysts was completed; The effect of low sulfur concentration in the feed on the life and activity of direct-methanation catalysts was studied; and A set of first-cut design data using an underground coal-gasification-type raw gas was obtained.

25274 **(PB—86-169109/XAB) Construction materials for coal conversion: performance and properties data. Supplement 2. Final report.** Ondik, H.M. (National Bureau of Standards, Washington, DC (USA). Ceramics Div.). Dec 1985. 695p. (NBS/SP—642-SUPPL-2). NTIS, PC A99/MF A01.

The book expands the information provided in the original NBS/SP 642 and in NBS/SP 642 Supplement 1 publications, Construction Materials for Coal Conversion--Performance and Properties Data. These volumes are intended to provide a central source of materials information needed for the fossil-fuel industry. Data were collected and evaluated from Department of Energy-sponsored projects. The book is organized so that the information is given both with respect to the various component areas of coal gasification, liquefaction, and direct combustion plants and also with

respect to the properties or possible failure mechanisms, e.g., corrosion, erosion, mechanical properties, and physical properties.

25275 **Process for the production of ethylene and other hydrocarbons from coal.** Steinberg, M.; Fallon, P. (to Dept. of Energy). US Patent 4,563,197. 7 Jan 1986. Filed date 15 Feb 1984. vp.

This patent describes a process for the production of ethylene from coal in commercially significant yields greater than 10% (% carbon converted to product) including the steps of: (a) reacting coal particulates entrained in a flow of gas consisting essentially of methane with the methane gas at a temperature in the approximate range of 850 degrees C to 1000 degrees C and at a partial pressure of approximately 50 psi for a period of time of approximately 1.5 seconds; and (b) recovering ethylene gas produced in the reaction from the product stream consisting of the methane and other reaction products in addition to the ethylene.

25276 **Definition and determination of the intrinsic rate of catalyzed Boudouard reaction.** Shadman, F.; Sams, D.A. (Department of Chemical Engineering, University of Arizona, Tucson, AZ). *Preprints of Papers, American Chemical Society, Division of Fuel Chemistry;* **29**: No. 2, 160-164(Apr 1984).

Impregnation with KOH reduces the surface area of the coal char possibly due to pore plugging. Upon gasification, however, the surface area increases rapidly and goes through a maximum. It is speculated that the increase in area at low conversions is due to catalyst mobility and unplugging of pores. The variation in rate during the catalytic gasification is complex and depends on the initial char properties. In general, the variation is mainly due to the interplay of three factors: the change in area, the change in K/C ratio and the catalyst loss. The trend of change in rate with conversion at the onset of gasification depends on the overall rate of loss of active sites. If the loss is fast compared to the main reaction, the gasification rate will decrease with conversion; otherwise it will increase. As the catalyzed char is gasified, the K/C ratio increases and the surface becomes saturated with catalytic sites. Before surface saturation, the variation in the gasification rate per unit mass is due to the change in K/C ratio and not the change in area. However, after surface saturation, the rate per unit mass is completely determined by the surface.

25277 **Catalyzed carbon gasification: thermal desorption studies on carbon-oxygen surface complexes.** Nuyak, R.V.; Jenkins, R.G. (Fuel Science Program, Department of Materials Science and Engineering, The Pennsylvania State University, University Park, PA). *Preprints of Papers, American Chemical Society, Division of Fuel Chemistry;* **29**: No. 2, 172-178(Apr 1984).

The exposure of a clean carbon surface to oxygen results in the formation of stable oxygen complexes. A large variety of studies, e.g., chemisorption, desorption, and spectroscopic, have been performed to understand the nature, composition and stability of these complexes. The programmed temperature desorption techniques have proved to be useful in yielding information on the total amount of oxygen present on the carbon surface, the amounts of CO and CO_2 in the desorbed product and the energetics of the complex desorption. Many workers have used temperature programmed desorption techniques to study the carbon-oxygen surface complexes. However, the majority of the work has been performed on "pure" carbons. Very little work has been conducted previously on the effect of added catalyst(s) on the decomposition of carbon-oxygen surface complexes. In recent studies on a graphatized furnace black, Vulcan 3 (V3G), it has been found that deposition of Pt on the carbon surface leads to significant enhancement of the C-O_2 reaction rate. To elucidate the cause of this enhanced reactivity it was decided to conduct linear temperature programmed desorption (LTPD) studies of the carbon-oxygen surface complexes formed on the Pt-V3G.

25278 **Global kinetics of primary and secondary reactions in hydrocarbon gas evolution from coal pyrolysis.** Serio, M.A.; Howard, J.B.; Peters, W.A.; Sawada, K. (Department of Chemical Engineering and Energy Laboratory, Massachusetts Institute of Technology, Cambridge, MA). *Preprints of Papers, American Chemical Society, Division of Fuel Chemistry;* **29**: No. 2, 65-76(Apr 1984).

The global pyrolysis kinetics of a Pittsburgh No. 8 Seam bituminous coal were studied previously in a reactor where volatiles are rapidly diluted and quenched upon exiting the coal, thereby reducing the extent of secondary reactions of primary products. Despite this feature, a significant decrease in tar yield occurs as the pressure is increased, implying that the nascent tar contains reactive components capable of significant secondary reactions under conditions of interest in commercial coal processing. A study was undertaken to systematically determine the effects of temperature (500 to 900°C), residence time (0.6 to 1.1 s), and contacting surfaces (coal char, active carbon, and quartz) on the homogeneous and heterogeneous secondary reactions of tar from a Pittsburgh Seam bituminous coal. In this paper, results for the formation kinetics of CH_4, C_2H_4, C_2H_6, and C_6's by primary pyrolysis of the coal and of CH_4 and C_2H_4 by vapor-phase cracking of the tar are presented. An earlier paper focused on the overall kinetics of the homogeneous and heterogeneous cracking of tar.

25279 **Thermal effects on the rapid devolatization of coal.** Vastola, F.J. (Department of Materials Science and Engineering, The Pennsylvania State University, University Park, PA). *Preprints of Papers, American Chemical Society, Division of Fuel Chemistry;* **29**: No. 2, 77-82(Apr 1984).

One of the major difficulties in the calculation of the kinetics of coal pyrolysis under conditions of rapid heating is the determination of the temperature history of the coal during the pyrolysis event. The temperature at which the pyrolysis occurs when a particle of coal is injected into a hot environment is dependent on the rate of heat transfer to the particle surface and the rate at which heat is transported through the particle. This latter transfer is further complicated by the heat absorbed or released by the pyrolysis reaction as well as phase changes that can occur within the particle. One method of obtaining data on the thermal response of coal under rapid heating conditions is to measure the variation in gas temperature when particles are injected into a hot gas environment where gas convection will play a significant role in the heat transfer process. By measuring local gas temperature in the vicinity of a particle injected into a hot environment the time of the heating-pyrolysis period can be measured and an estimate can be made of the relative contributions of gas convection and radiation to the process.

25280 **The variation of coal pyrolysis behavior with rank.** Solomon, P.R.; Carangelo, R.M.; DiTaranto, M.B.; Hamblen, D.G.; Markham, J.R. (Advanced Fuel Research, East Harford, CT). *Preprints of Papers, American Chemical Society, Division of Fuel Chemistry;* **29**: No. 2, 83-93(Apr 1984).

Coal pyrolysis is important since it is the initial step in most coal conversion processes and is the step which is most dependent on the properties of the coal. Recent reviews of the pyrolysis literature present a complicated profusion of results in which it is difficult to identify any simplifying order. The purpose of this paper is to provide some understanding of the diversity in the reported data.

25281 **Coal liquefaction by steam pyrolysis.** Graff, R.A.; Brandes, S.D. (The Clean Fuels Institute, The City College CUNY, New York, NY). *Preprints of Papers, American Chemical Society, Division of Fuel Chemistry;* **29**: No. 2, 104-111(Apr 1984).

A key to obtaining high liquid yields in steam pyrolysis of coal has been found to be pretreatment in steam at low temperature. In tests reported here, coal is pyrolyzed in steam at a pressure of 50 atm. by flash heating to temperatures from 870 to 980°C. In the absence of pretreatment about 23% of the coal's carbon is converted to liquid product. If, however, the coal is first exposed to 50 atm. of steam for less than 30 min. at temperatures from 320 to 360°C, over 50% carbon conversion to liquids is obtained in subsequent pyrolysis. From the experimental results and discussion we

conclude that important changes in the structure of coal occur at temperatures below 350°C. Although a number of potential explanations may be suggested, it seems likely that coal is partially depolymerized during pretreatment, resulting in higher yields of volatiles in a subsequent pyrolysis. The effect is not solely thermal; the presence of water significantly improves product yields.

25282 **Cold atmosphere pyrolysis of pulverized coal using 10.6μM laser heating.** Ballantyne, A.; Chou, H.; Neoh, K.; Orozco, N.; Stickler, D. (Avco Everett Research Laboratory Inc., Everett, WA). *Preprints of Papers, American Chemical Society, Division of Fuel Chemistry;* **29**: No. 2, 119-128(Apr 1984).

The pyrolysis behavior of three different coals was explored in a unique experimental arrangement that inhibited secondary reactions of the primary volatiles. They were transported as particulate suspensions in room temperature nitrogen, and heated to particle temperatures in the range 1300-1800K at about 10^5K/s by a 10.6μm laser beam. This approach allows well-controlled heating with good time/space resolution, and very rapid thermal quenching of primary volatiles by diffusion into the cold nitrogen. A key result is that gas phase C species account for less than one percent of the coal C although H_2O comparable to the coal moisture content is evolved. Residual solids have proximate and ultimate analyses very close to that of the raw coals but significantly enhanced solubility. It appears that tarry volatiles are produced with minimal change in chemical bonding and recondense in the cold gas flow. This suggests that primary coal volatiles are of high molecular weight, with subsequent gas phase decomposition giving low molecular weight products in hot atmospheres.

25283 **Enhanced ethylene production via flash methanolysis of coal.** Sundaram, M.S.; Fallon, P.; Steinberg, M. (Department of Applied Science, Brookhaven National Laboratory, Upton, NY). *Preprints of Papers, American Chemical Society, Division of Fuel Chemistry;* **29**: No. 2, 129-140(Apr 1984).

In an on-going pyrolysis research project at the Brookhaven National Laboratory, the methods to increase the yield of ethylene through flash methanolysis of coal is being investigated. Flash methanolysis is defined as pyrolysis of coal under pressure in an atmosphere of methane. This study attempts to identify the influence of important process variables such as reaction temperature, gas pressure, solids residence time, gas/solids ratio etc. on the production characteristics of ethylene and other pyrolysis products.

25284 **Role of exchangeable cations in concurrent gasification/pyrolysis of lignites.** Morgan, M.R.; Jenkins, R.G. (Department of Materials Science and Engineering, The Pennsylvania State University, University Park, PA). *Preprints of Papers, American Chemical Society, Division of Fuel Chemistry;* **29**: No. 2, 141-145(Apr 1984).

Gasification and combustion of the large reserves of American lignites is an area of intense research. This research, coupled with economic incentives, has led to the current project to build and operate the first large-scale coal gasifier using lignites from North Dakota. However, much work is necessary in order to be able to understand and predict the behavior of these coals. In this paper, the role of ionexchangeable alkali and alkaline-earth metals in the gasification/pyrolysis of lignites is addressed. These cations, which are peculiar to low-rank coals, are known to have a significant influence on the utilization behavior of lignites. Exchangeable metal cations have been found to affect coal pyrolysis (1,2) and coal-char gasification (3). The goal of this paper is to illucidate the way in which exchangeable cations affect coal gasification in terms of their role in coal pyrolysis, char gasification and the interaction between the two.

0105 By-products

REFER ALSO TO CITATION(S) 25946

0106 Properties

REFER ALSO TO CITATION(S) 25277, 25278, 25279, 25280, 25446

25285 **(DOE/ET/10532—T30) Refining and upgrading of synfuels from coal and oil shales by advanced catalytic processes. Quarterly report, July-September 1985.** Sullivan, R.F. (Chevron Research Co., Richmond, CA (USA)). Nov 1985. Contract AC22-76ET10532. 17p. (FE—2315-122). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86004223.

The work to date under Task 12 of this contract has been on upgrading of product from the Integrated Two-Stage Liquefaction (ITSL) process. Recently, Task 12 was further modified to add another sub-task, the upgrading of product from another two-stage liquefaction process. This process is referred to as Low Severity Two-Stage Catalytic (LSTSC) Liquefaction or Catalytic Two-Stage Liquefaction (CTSL). It is being developed by Hydrocarbon Research, Inc. The distillate feedstock arrived in August 1985, and experimental work has been started. This report gives analyses of the feedstocks. This report also includes, as an appendix, a paper "Effects of Feed Boiling Range on Hydrotreating of Wyodak and Illinois ITSL Oils," prepared for presentation at the November 1985 DOE Direct Liquefaction Contractors Review Meeting at the request of DOE. This paper has also been processed for inclusion in the Energy Data Base. 2 figs., 2 tabs.

25286 **(DOE/FC/10621—2027) Thermal properties and fluid diffusivities related to low-rank coal, its char and ash. Technical progress report, October 1-December 31, 1985.** Ramirez, W.F. (Colorado Univ., Boulder (USA). Dept. of Chemical Engineering). Jan 1986. Contract AC18-84FC10621. 7p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86008200.

The purpose of this study is to determine the thermal conductivity, thermal diffusivity, density, and heat capacity of low-rank coals. Powdered and homogeneous coal samples are being used in this study with their properties being measured under a variety of conditions of temperature and pressure. In addition, measurements are done on dried and undried coal samples to determine the effect of moisture content on the thermal properties. During this fourth quarter, thermal properties of the powdered coals were first measured as a function of pressure from 800 millitorr to 100 psig at room temperature. Properties were then measured as a function of temperature from 20 to 300°C. During these measurements, the sample container was sealed and the pressure was allowed to come to its equilibrium value for a given temperature. Values for the thermal properties are given in Tables 2 and 3. 3 tabs.

25287 **(DOE/FE/60181—168) High resolution x-ray fluorescence spectroscopy: a potentially useful technique for chemical bonding studies in fossil fuels.** Andermann, G.; Fujiwara, F.; Worman, J. (Hawaii Univ., Honolulu (USA). Dept. of Chemistry; North Dakota Univ., Grand Forks (USA). Energy Research Center). 1986. Contract FC21-83FE60181. 15p. (CONF-860425—21). NTIS, PC A02/MF A01; GPO Dep. File Number DE86008812.

From 191. American Chemical Society national meeting; New York, NY, USA (13 Apr 1986).

The objective of this paper is to present x-ray fluorescence spectroscopy (XFS) in a new role at high optical resolution, namely, as a potentially useful tool for a direct determination of the valence electron structures around the different kinds of atoms of interest. While it may be premature to assert with any degree of certainty the potential analytical capabilities of XFS for characterizing the nature and amount of different functional groups, a few generalizations are in order. Judging from the position of the oxygen lone pair peaks in squaric acid, it should be feasible to distinguish between -C=O and -C-OH groups. In the case of carboxylic acids the C-K emission is highly simplified and the halfwidth of the lone pairs should provide a handle on the presence and quantity

of mono or polycarboxylic acids. An unsaturated ring system provides a unique C/sub 2p/-C/sub 2p/ π band, and conceivably, the integrated intensity might yield useful information about the extent of unsaturation. XFS to determine sulfur functionality appears to provide a unique capability in determining the degree of saturation in the sulfur heterocyclic substances, as well as the capability in determining the nature of the atoms directly linked to the sulfur atom. While the above fundamental studies appear to be encouraging, clearly it will be necessary to evaluate directly the analytical capabilities of XFS for coal characterization. Preliminary studies are currently under way. 15 refs., 13 figs.

25288 (DOE/PC/60804—T10) Thermophysical properties correlations and pseudocomponent characterization parameter estimation for fossil fluids. Second quarterly report (III year). Starling, K.E.; Lee, L.L.; Ellington, R.T.; Khan, M.A.; Mannan, M.; Sheth, K. (Oklahoma Univ., Norman (USA). School of Chemical Engineering and Materials Science). 1986. Contract FG22-83PC60804. 11p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86008784.

This report summarizes work performed during the period December 1, 1985 through February 28, 1986. During this period, a data bank for the viscosity of coal derived liquids was treated. The Gulf Research and Development Company has conducted measurements for various thermophysical properties of narrow boiling range coal liquids from the SRC-II process. Data for 17 undefined fractions include measurements of viscosity, thermal conductivity, density, vapor pressure, specific heat, surface tension, and heat of vaporization. Molecular weight, boiling point, and specific gravity for each distillation cut are also reported. Data on various properties of coal liquids produced from the Exxon Doner Solvent coal liquefaction process are also reported in literature. 3 tabs.

25289 (PB—86-121209/XAB) Estimates of analytical accuracy, repeatability, and reproducibility from EPA (Environmental Protection Agency) National Coal Audit Program data. Logan, T.J.; Baker, S.S.; Streib, E.W.; Midget, M.R.; Pitts, W.S. (Environmental Protection Agency, Research Triangle Park, NC (USA). Environmental Monitoring and Systems Lab.). Oct 1985. 17p. NTIS, PC A02/MF A01.

The accuracy, repeatability, and reproducibility of coal sulfur, moisture, and Btu determinations were estimated from results reported during four rounds of EPA's National Coal Audit Program (NCAP). Overall, the data examination indicates that in instances where coal analysis data are used for determining source-specific SO_2 emissions, there may be a need for enhanced analytical quality-assurance and quality-control measures.

25290 (PB—86-150380/XAB) Reactivity of coal and the prevention of spontaneous heating in coal in stockpiles in South Africa - second supplement. Coetzee, S.D. (National Inst. for Coal Research, Pretoria (South Africa)). 29 May 1985. 86p. (COAL—8509). NTIS, PC A06/MF A01.

Coalification is a process in which molecular order is being derived from disorder. Quantum mechanical energy levels are initiated that increase in energy with rise in overburden pressure, but on erosion or removal of pressure the surplus energy is spent spontaneously. On being mined, the coalification process reverts to one in which disorder due to oxidation becomes predominant. This characteristic of coal gives rise to the fact that all coal components become liable to spontaneous heating. The formation of coal is reviewed bearing in mind quantum mechanical reactions in macromolecules as well as the configuration of the system (coal molecule) which is capable of existing in a stable form in a particular milieu. The prevention of spontaneous heating is based on the preclusion of oxygen from the coal and the maintenance of an inert atmosphere within the stockpile. The method recommended for stockpiling is discussed, and the tests for spontaneous heating as well as the quality of the atmosphere within the stockpile are described.

25291 (PNL—5605) HRI catalytic two-stage liquefaction (CTSL) process materials: chemical analysis and biological testing. Wright, C.W.; Later, D.W. (Pacific Northwest Labs., Richland, WA (USA)). Dec 1985. Contract AC06-76RL01830. 125p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE86008788.

This report presents data from the chemical analysis and biological testing of coal liquefaction materials obtained from the Hydrocarbon Research, Incorporated (HRI) catalytic two-stage liquefaction (CTSL) process. Materials from both an experimental run and a 25-day demonstration run were analyzed. Chemical methods of analysis included adsorption column chromatography, high-resolution gas chromatography, gas chromatography/mass spectrometry, low-voltage probe-inlet mass spectrometry, and proton nuclear magnetic resonance spectroscopy. The biological activity was evaluated using the standard microbial mutagenicity assay and an initiation/promotion assay for mouse-skin tumorigenicity. Where applicable, the results obtained from the analyses of the CTSL materials have been compared to those obtained from the integrated and non-integrated two-stage coal liquefaction processes. 18 refs., 26 figs., 22 tabs.

25292 (STEV-TORV—85-25) Mechanical strength in sod peat. Development of laboratory testing methods for determination of tumbler strength and compression strength. Sandstroem, T.; Burvall, J. (Statens Energiverk, Stockholm (Sweden)). Aug 1985. 33p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. File Number DE86751533.

In this report tumbler strength has been evaluated in combination with compression strength. During the project a high pressure press was modified. At the compression a thrust load equivalent to a ground pressure of 0-5 kp/cm^2 was used. Low humified sphagnumpeat had the best strength, both with and without compression. For low humified sphagnumpeat, compressed with 2 kp/cm^2 and then tumbled in a rotating drum, the crush content increased to about 5% absolute numbers for pieces less than 45 mm, while the other types of peat increased to 12-15%, in comparison with the tumbler strength merely. These studies show that compression strength in combination with tumbler strength elaborate on the results we have received from tumbler strength only. In this investigation we have not found any further information about low humified sphagnumpeat as compared to other kinds of peat. The precision of the method combining tumbler strength with compression strength is not satisfying. In the future, the sod peat machinery will probably produce a more tenable sod peat. It means that compression strength should be a part of the investigation of the mechanical strength for sod peat. For additional studies in the future, a better equipment for compression strength ought to be developed, and further knowledge studies must be done.

25293 (SVF—161) Quality evaluation of coal for minor plants. Stage II. Palmgren, M. (Stiftelsen foer Vaermeteknisk Forskning, Stockholm (Sweden)). Jun 1984. 63p. (In Swedish). NTIS (US Sales Only), PC A04/MF A01. File Number DE86751537.

On a tour in Denmark and West Germany and within the scope of the subject, engineers have visited industrial power plants as well as municipal district heating plants using coal-fired boilers furnished with grates. The purpose of the trips were to obtain experiences from owners and manufacturers of grate-fired boilers, especially regarding coal-qualities and coal properties essential for combustion. This report contains technical descriptions and operation experiences from boiler plants furnished with spreader-stoker, travelling grate, chain grate drop-tube and vibrating grate. Finally, the report contains a part with conclusions and recommendations concerning suitable coal-qualities and coal-properties for common types of grates.

25294 (VTT-TIED—332) New coal technology, Part 1. Petrography, classification proposal and deep-cleaning of coal. Aeijaelae, M.; Moilanen, A.; Panula, E. (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)). May 1984. 53p. (In Finnish). NTIS (US Sales Only), PC A04/MF A01. File Number DE86751563.

Petrography is becoming a new determination method of coal characteristics. With the aid of this method it is possible to determine such properties of coal that in part interpret the behaviour of coal in different processes. The method has already been used in the coking of coal. If affords, for example, an opportunity of evaluating the suitability of different facilities for the combustion of coal of a new type. Data has been gathered on the use of petrography

and on its suitability for evaluating the behaviour of coal. The method of coal cleaning is based, on one hand, on increasing operation difficulties as a consequence of deteriorating coal grades, and on the other hand, on requirements of reducing environmental impacts, primarily sulphur emissions. Coal cleaning has also connections with coal technology and centralized coal powder manufacture. Competing methods are primarily flue gas scrubbing in sulphur retention and fluidized bed technique, which is being developed intensively. Coal research within the International Energy Agency (IEA) is in part done as permanent projects through NCB (IEA Services) Ltd. and in part as short-term projects between separate countries, where the IEA acts only as the coordinator. NCB Ltd also includes Technical Information Service.

25295 **Abstracts and research accomplishments of university coal research projects.** Pittsburgh, PA; Pittsburgh Energy Technology Center (1985). 193p.

The principal investigators of the grants supported by the University Coal Research program were requested to submit abstracts and highlight accomplishments of their projects. This book is a compilation of the material received in response to the request. Project abstracts are arranged under the following headings: coal science; surface science; reaction chemistry; mechanisms and kinetics; thermodynamics; and general topics.

25296 **Abstracts and research accomplishments of physical, chemical and thermodynamic properties projects.** Pittsburgh, PA; Pittsburgh Energy Technology Center (1985). 28p.

The principal investigators of the grants supported by the Physical, Chemical and Thermodynamic Properties of Fossil Fuels program were requested to submit abstracts and highlight accomplishments of their projects. This book is a compilation of the material received in response to the request nine projects are described.

0108 Waste Management

REFER ALSO TO CITATION(S) 25265, 25289, 25357, 25810, 25811, 25812, 26156, 26158

25297 **(DOE/FE/60181—2002) PDU scale nitrification and denitrification of Great Plains Gasification Plant's stripped gas liquor.** Gallagher, J.R.; Shockey, R.E.; Mayer, G.G. (North Dakota Univ., Grand Forks (USA). Energy Research Center). Feb 1986. Contract FC21-83FE60181. 38p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86008840.

Gasification wastewater treatment at UNDERC has focused on treating wastewater to suitable quality for reuse. Reuse criteria have centered on reduction of organic compounds; the major reuse option for these wastewaters has been for cooling water. Pilot studies at UNDERC have demonstrated that significant quantities of ammonia will be stripped in a cooling tower using stripped gas liquor as makeup, requiring further reductions in ammonia concentrations prior to reuse. Moreover, reuse can be very expensive due to the cost of chemical additives, high corrosion of construction materials and other expenses. Therefore, interest has developed in treatment of these wastewaters for discharge. Nitrogen removal to low concentrations will be required for discharge of these wastewaters and may be required for most reuse options. Biological removal of nitrogen from Great Plains Gasification Plant's stripped gas liquor (SGL), through the processes of nitrification and denitrification, are the subject of this report. Over 43,000 liters (11,360 gallons) of pretreated SGL were nitrified in 3 PDU scale reactors, and 14,500 liters (3800 gallons) of this wastewater were denitrified. The kinetics of nitrification were determined by obtaining removal data simultaneously in three activated sludge reactors operating at different solids retention times. Suspended growth (activated sludge) complete-mix, stirred-tank reactors were used for this research. Process performance data for nitrification and denitrification are reported. Essentially complete removal of ammonia, at influent concentrations of greater than 500 mg/l NH_3-N, was observed, and influent nitrate-N concentrations of greater than 750 mg/l were completely denitrified. 16 refs., 25 figs., 7 tabs.

25298 **(DOE/MC/20229—T1) Low emission combustor technology.** White, D.J. (Solar Turbines, Inc., San Diego, CA (USA)). Apr 1985. Contract AC21-82MC20229. 51p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE86007918.

A two-stage coal-water slurry high-pressure gas turbine combustion system employing a primary zone with a hot refractory wall and on internal slag removal system has been designed, built and tested. The molten ash is removed by aerodynamic means using a form of jet impaction, a method that promises to be more effective than the more conventional cyclonic approaches. The overall combustion system is extremely flexible and can be readily configured to operate either with a lean or a rich reaction (primary) zone. In both cases a lean secondary zone is used. Results showing emission signatures of a numer of coal-water slurry fuels operating with the combustor arranged in a rich primary zone configuration are presented. Petroleum based fuels show emission trends that are very similar to those previously published. Coal-water slurry combustion, however, results in emission signatures that cover only a relatively narrow fuel-air ratio range because of the limited combustion stability. NO/sub x/ emissions have been obtained that meet EPA regulations for stationary gas turbines.

25299 **(EPRI-CS—4384-Vol.1) Recovery of metal oxides from fly ash including ash beneficiation products. Volume 1. Product market survey report. Final report.** Wilder, R.F.; Markman, D.L. (Kaiser Engineers (California) Corp., Oakland, CA (USA)). Feb 1986. 74p. Research Reports Center, Box 50490 Palo Alto, CA 94303. File Number TI86920197.

This report summarizes the information assembled to investigate the potential markets for products which may be produced by beneficiating and processing coal fly ash by the Direct Acid Leach Process as an alternate to the cost and long term environmental impacts of continued ash disposal. This market study identifies, evaluates, and reviews the marketability of potential products including raw and leached ash products as well as the valuable metal oxides and industrial salts which would be extracted and recovered. Potential markets appear to be available at net revenues and volumes capable of supporting viable commercial facilities. Producing samples of the various products in pilot plant facilities of quality to meet or exceed commercial specifications and in sufficient quantity for confirmation of the market's capabilities and values appears to be an appropriate further program.

25300 **(EPRI-CS—4442) Modeling sulfur capture by recycle fines in fluidized-bed combustion. Final report.** Rickman, W.S. (GA Technologies, Inc., San Diego, CA (USA)). Mar 1986. 83p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI86920233.

A model was developed to predict the effect of cyclone fines recycle on sulfur capture in an atmospheric fluidized bed coal combustor. Process variables accounted for in the model include Ca/S ratio, fines recycle ratio, superficial velocity, bed depth, bed particle size, fines particle size, cyclone efficiency, limestone properties, fine-particle residence time, and fine-particle sulfation rate. Existing sulfur capture models were reviewed. A method for determining fine-particle residence times was reviewed and incorporated into the model. Model results showed that the use of finer sorbents and higher recycle rates gave the best sulfur capture performance.

25301 (KFK-PEF—2, pp 473-492) **Dry limestone and dolomite flue gas desulfurization: Improvement of sulfur dioxide sorption by optimum pore structure, by pelletizing and by chemical activation of the sorbent.** Weisweiler, W.; Hoffmann, R.; Stein, R. (Karlsruhe Univ., T.H., Germany, F.R. Inst. fuer Chemische Technik). Apr 1985. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86751479. (CONF-8503225—).

From 1. status colloquium of the European Research Center project for air pollution abatement measures (PEF) of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (5 Mar 1985).

Studies on desulfurization of flue gas (0.05 to 0.7 vol.% SO_2 in water vaporair mixtures) with calcium containing sorbents (particle size 500-710 μm) were performed in a fluidized-bed laboratory-

reactor. Using calcined dolomite, optimum SO_2 sorption is obtained at 400°C. $CaSO_3$. 0,5 H_2O is the main product. Raw dolomite can desulfurize beyond 500°C and maximum conversion to $CaSO_4$ is reached at 850°C. Vapor phase hydrated lime reacts at 400°C with SO_2 mainly to form $CaSO_3$. 0,5 H_2O and at 800°C to form $CaSO_4$. The reactivity is found to be nearly independent of the reaction temperature. With chemically activated and pelletized limestone the sulfation capacity can be increased up to 100%.

25302 (KFK-PEF—2, pp 553-562) **Two-phase flow upstream and downstream to a droplet separator of a flue gas scrubber.** Conrads, M.; Klar, M.; Reske, R.; Wachter, C.; Wurz, D. (Karlsruhe Univ., T.H., Germany, F.R. Inst. fuer Technische Thermodynamik). Apr 1985. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86751479. (CONF-8503225—).

From 1. status colloquium of the European Research Center project for air pollution abatement measures (PEF) of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (5 Mar 1985).

Many breakdowns and failures in flue gas treatment plants result from deposits and scales in droplet separators and pure-gas ducts. The study on hand examines two-phase flow occuring upstream and downstream to the droplet separator particularly under aspects of blower arrangement in the wet pure-gas flow. Measurement methods were further developed for differentiating absorber suspension droplets and recondensation droplets, droplets of a different pH value and flue gas dust and absorber dust. 'Semi-technical' bench-scale tests established separation rates of droplet separators obtainable under ideal arrangement conditions. Residual droplet loads below 10 mg x m^{-3} are obtainable for droplet diameters above 10 μm. The first field measurement was performed in the Wilhelmshaven power plant of the NWK-AG company. Results: residual droplet load c. 30 mg x m^{-3}, percentage of absorber suspension droplets 10%, - many large secondary droplets, - high separation rate for flue gas dust, - pure-gas dust load < 10 mg x m^{-3}. A differential method was developed for optimizing droplet separator geometry.

25303 (PB—86-132396/XAB) **Identification of soil-water chemical parameters for the prediction and treatment of suspended solids in surface-water reservoirs of coal-mine lands, July 1984-August 1985. Research report.** Evangelou, V.P.; Grove, J.H.; Barnhisel, R.I. (Kentucky Water Resources Research Inst., Lexington (USA)). Jul 1985. 49p. (RR—160). NTIS, PC A03/MF A01.

High concentrations of suspended solids in coal-mine sedimentation ponds are a factor in lowering water quality. Colloidal-particle settling simulations were carried out in the laboratory to test the influence pH and dissolved solids have on concentration and settling rates of suspended solids. The results of the study reveal that the pH of colloidal coflocculation for the samples tested is between 3.5 and 4.5. This increase was dependent on the magnitude of the sodium adsorption ratio (SAR). The greater SAR systems maintained a greater concentration of colloidal suspended particles. The data also show evidence that for the same SAR values when substituting magnesium for calcium, the rate of particle settling increased for one sample but decreased for another.

25304 (PB—86-136165/XAB) **Modeling of SO_2 removal in spray-dryer flue-gas desulfurization system. Final report, November 1983-June 1984.** Damle, A.S. (Research Triangle Inst., Durham, NC (USA)). Dec 1985. 86p. (REPT—47U-2247-4). NTIS, PC A05/MF A01.

The report presents a comprehensive mathematical model of the SO_2 removal process in a spray-dryer flue-gas desulfurization system. Simultaneous evaporation of a sorbent droplet and absorption/reaction of SO_2 in the droplet are described by the corresponding heat- and mass-transfer rate relations. Dissolution kinetics of lime particles within a slurry droplet is included in determining the overall SO_2 removal rate. The model identifies several important parameters that need to be estimated or determined from experimental data. The report also includes a computer program, SPRAYMOD, written in Basic language, to predict SO_2 removal in a spray dryer, based on the model developed. The program is user oriented and easy to use. The contribution of particulate collection equipment, a baghouse and an electrostatic precipitator, toward overall SO_2 removal is also discussed.

25305 (SAND—84-1719) **Centrifuge modeling of coal tailing embankments.** Rechard, R.P.; Sutherland, H.J.; Heckes, A.A. (Sandia National Labs., Albuquerque, NM (USA)). Mar 1986. Contract AC04-76DP00789. 34p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86008877.

Centrifuge model studies were conducted on eight homogeneous dams with 1.75:1 slopes using coal tailings (waste coal, shale, fine sand, silt, and clay) to obtain experience on the behavior of this low-strength material in a laboratory setting and, further, to examine the accuracy of predictions of embankment failure by the simplified Bishop limit equilibrium method. The failure of four of the model embankments simulated typical features of slope failures observed in the field. Centrifuge modeling verified that the simplified Bishop method using standard measurements of soil strength properly indexed the dam safety but did not accurately locate the embankment failure surface. 20 refs.

0109 Environmental Aspects

REFER ALSO TO CITATION(S) 25303, 25532, 25536, 26147, 26301

25306 (DOE/FE/55014—T16) **Great Plains Coal Gasification project. Quarterly environmental report, third quarter, 1985.** (ANG Coal Gasification Co., Beulah, ND (USA)). Oct 1985. Contract FM02-82FE55014. 241p. NTIS, PC A11/MF A01; 1; GPO Dep. File Number DE86008805.

Environmental monitoring, supplemental environmental programs and quality assurance/quality control activities are covered in this quarterly report. Under the environmental monitoring program, the following topics are covered: permitting activities; ambient monitoring; plant discharge monitoring; pollution control unit emissions; surface mining and reclamation; and environmental incident summary. The supplemental environmental program covers: performance survey; wastewater control and steam generation system; sulfur control; tar reinjection outage; gasifier effluent control systems; toxicity screening study; toxicant characterization; data base management system; workplace characterization; fugitive emissions; epidemiology; atmospheric program; effects of cooling tower effluents on terrestial ecosystems; and contingency program. 15 figs., 56 tabs.

25307 (DOE/FE/55014—T19) **Great Plains Coal Gasification Project. Quarterly environmental report, fourth quarter 1985.** (ANG Coal Gasification Co., Beulah, ND (USA)). Jan 1986. Contract FM02-82FE55014. 380p. NTIS, PC A17/MF A01; 1; GPO Dep. File Number DE86008806.

Environmental monitoring, supplemental environmental programs and quality assurance/quality control activities are covered in this quarterly report. Under the environmental monitoring program, the following topics are covered: permitting activities; ambient monitoring; plant discharge monitoring; pollution control unit emissions; surface mining and reclamation; and environmental incident summary. The supplemental environmental program covers: performance survey; wastewater control and steam generation systems; sulfur control; tar reinjection outage; gasifier effluent control systems; toxicity screening study; toxicant characterization; data base management system; workplace characterization; fugitive emissions; epidemiology; atmospheric program; effects of cooling tower effluents on terrestial ecosystems and contingency program. 14 figs., 66 tabs.

25308 (PB—86-140118/XAB) **Federal coal management program. Final environmental impact statement supplement. Volume 1. Chapters 1-7.** (Bureau of Land Management, Denver, CO (USA). Div. of Environmental Impact Statement Services). Oct 1985. 630p. (BLM/YA/ES—85/007/4121-VOL-1). NTIS, PC A99/MF A01.

The purpose of the supplemental environmental impact statement (EIS) is to analyze the potential environmental consequences of continuing the federal coal management program or of implementing three alternatives to it. The document was prepared to

supplement the 1979 Federal Coal Management Program Final Environmental Statement (1979 FES) (BLM 1979a) because many changes have occurred or are proposed in the coal program and because of changes in energy market conditions that formed the basis for the 1979 analysis.

25309 **(PB—86-140126/XAB) Federal coal management program. Final environmental impact statement supplement. Volume 2. Appendixes, glossary, and references.** (Bureau of Land Management, Denver, CO (USA). Div. of Environmental Impact Statement Services). Oct 1985. 662p. (BLM/YA/ES—85/007/4121-VOL-2). NTIS, PC A99/MF A01.

The purpose of the supplemental environmental impact statement (EIS) is to analyze the potential environmental consequences of continuing the federal coal management program or of implementing three alternatives to it. The document has been prepared to supplement the 1979 Federal Coal Management Program Final Environmental Statement (1979 FES) (BLM 1979a) because many changes have occurred or are proposed in the coal program and because of changes in energy market conditions that formed the basis for the 1979 analysis.

25310 **(PB—86-147519/XAB) Method of synthesizing sprinkler spray patterns. Research report.** Watkins, R.D. (Sydney Univ. (Australia). School of Civil and Mining Engineering). Jun 1983. 43p. (R—449). NTIS, PC A03/MF A01.

There are practical difficulties in obtaining data on water-sprinkler spray patterns over coal stockpiles under various wind conditions. A method is developed for synthesizing the spray-droplet patterns, based on laboratory tests to observe the droplets discharged from a sprinkler nozzle; this data is employed with the theoretical equations for droplet movement to calculate the trajectories of representative spray droplets, including cases where local air flows due to wind are important. From observations made by Watkins in the course of wind tunnel model studies of wind effects over coal stockpile areas, it was evident that local air flows could have a marked effect on the trajectories of water droplets from water sprinklers used for dust suppression.

0120 Mining

REFER ALSO TO CITATION(S) 25263, 25264

25311 **(PB—86-139003/XAB) Abstracts of publications and reports from Coal Mining Technology Tesearch. Open file report.** Fowkes, R.S.; Mytrysak, C.A. (Bureau of Mines, Pittsburgh, PA (USA). Pittsburgh Research Center). Aug 1984. 221p. (BM-OFR—122-85). NTIS, PC A10/MF A01.

The report contains abstracts describing articles, papers, and reports dealing with the contract research results of the Coal Mining Technology Research Program. The report is divided into four major areas: (1) general, (2) underground mining, (3) surface mining, and (4) mine systems. The underground mining section is subdivided into mine planning, mine development, production systems, and logistics. The surface mining section is subdivided into mine planning, production systems, logistics, and reclamation. Within each category, projects are listed chronologically from the earliest to the latest publication.

0130 Transport And Handling

REFER ALSO TO CITATION(S) 25292, 25294

25312 **(SVF—162) Receiving stations for coal and other solid fuels.** Permeus, G. (Stiftelsen foer Vaermeteknisk Forskning, Stockholm (Sweden)). 1984. 127p. (In Swedish). NTIS (US Sales Only), PC A07/MF A01. File Number DE86751542.

This report discuss design of receiving stations at solid fuel plants. The author tries to show how different technical solutions can be adapted to the local conditions, such as type of fuel, receiving capacity and means of transport: container, truck, railway carriage or a combination. Reports are given from projects with different technical solutions, where mistakes and advantageous solutions are pointed out.

25313 **(VTT-TIED—279) Transport of peat and peat products.** Jantunen, M.; Arpiainen, V. (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)). Jan 1984. 38p. (In Finnish). NTIS (US Sales Only), PC A03/MF A01. File Number DE86751562.

Transport of peat (milled peat and sod peat) and peat products was studied both with regard to transportation techniques and economy. In addition to the traditional peat products (briquettes and pellets), gas and synthetic gasoline, electricity and district heat were also included in the peat products. As regards the last mentioned end products, only their transportation costs were studied. The following modes of transport were studied where applicable: railway transports, road transports (by trailer and tractor), pipelines (district heat and gas), ship and barge transports and powerline. cost analysis was confined to other than water transports. An automatic data processing program was prepared for the calculation of transport costs, and a number of cases were calculated with the aid of this program.

0140 Combustion

REFER ALSO TO CITATION(S) 26016, 26017, 26180

25314 **(BNL—51939) Compact coal combustor with integral dry ash removal. Annual report, October 1, 1983-September 30, 1984.** Krishna, C.R. (Brookhaven National Lab., Upton, NY (USA)). 1984. Contract AC02-76CH00016. 23p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86008797.

A promising approach for conversion to coal of existing oil and gas-fired boilers is to retrofit with a combustor that removes most of the ash before the boiler. The present project has resulted in the design and preliminary proof-of-concept testing of such a combustor. The outstanding characteristics of this non-slagging, dry ash removal combustor are listed: (1) Combustion and dry ash removal in one compact unit confines deleterious ash effects (corrosion-erosion) to this stage. (2) Dry ash operation throughout allows use of lower temperature and less costly materials or, with the best available materials, longer life and high reliability. Corrosion by slag, slag tap plugging and the difficulties of handling molten ash are avoided. Low temperature operation is more compatible with pre-cleaned coal water mixture as the fuel. (3) Simple inertial ash separation can be independently controlled to give reliable and effective ash removal even under turndown conditions. (4) The dry ash operation and the independent control of ash separation assures stable and good performance under turndown while the need to maintain a thin mobile slag layer, in the case of the slagging cyclones, would make it sensitive to turndown. (5) Dry ash combustion of moderately loaded CWM's (50% coal) without support fuel and external air preheat has been demonstrated on the test unit. (6) Excellent carbon conversions (greater than 90%) have been attained over a wide range of thermal inputs, combustion intensities and air-fuel ratios. (7) The potential for dry ash removal has been shown with removal efficiencies greater than 60% overall. The next logical step toward commercialization of this technology, requires generation of a data base by testing a larger size, more representative unit. 11 figs., 8 tabs.

25315 **(DOE/PC/40796—T1) Carbon attrition during the fluidized combustion and gasification of coal. Final report, 1981-1985.** Massimilla, L.; Borriello, L.; D'Amore, M.; Donsi, G.; Farina, B.; Filla, M.; Mazza, A.; Arena, U.; Cammarota, A.; Chirone, R. (Naples Univ. (Italy). Dipartimento di Ingegneria Chimica; Consiglio Nazionale delle Ricerche, Naples (Italy). Ist. di Ricerche sulla Combustions). 1985. Contract FG22-81PC40796. 134p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE86006155.

This report includes: the summary on the status of research on carbon attrition in Naples at the time the proposal was accepted by DOE in the framework of Fossil Fuel Program; the description of the proposed research program, the presentation of experimental results, a brief discussion on application of results to design and

conclusion. Details of results are in papers published in technical journals, or presented at international meetings on fluidized combustion and related topics. These papers are marked with an asterisk in the Cited Literature. 45 refs., 45 figs., 10 tabs.

25316 **(DOE/PC/50808—T10) Elementary processes in combustion and sooting of coal-derived fuels. University coal research. Final report.** McVey, J.K. (Princeton Univ., NJ (USA). Dept. of Chemistry). 1986. Contract FG22-82PC50808. 17p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86008679.

In this final report, a review of the major results and accomplishments are presented. This research program examined the role of several key radical-radical, radical-molecule and ionic decomposition reactions important in the formation of soot. In light of the then predicted increased use of fossile-based synfuels, a better understanding of the combustion of aromatic-rich fuels seemed imperative as these materials are particularly prone of form soot. Objectives of this work included developing techniques for the efficient generation of gas-phase radicals and ions, probes of their reaction dynamics, and finding new procedures for stabilization of reaction intermediates in combustion. Five specific issues examined in this study are discussed and summarized in this report: (1) the reactivity of phenyl radicals, (2) chemistry of diradicals generated from laser induced decomposition of cyclic ketones, (3) reactions of butadiene radicals, (4) reactions of gas-phase methylene, and (5) selective generation and induced decomposition of phenyl-based cations. New techniques for examining the kinetics of fast, combustion-related systems were developed using free jet expansion cooling of reaction intermediates and in using ultraviolet multiphoton ionization techniques for initiation of chemical sequences.

25317 **(DOE/PC/70815—T6) Kinetics of coal combustion. 4th quarterly report.** Gat, N. (TRW Space and Technology Group, Redondo Beach, CA (USA)). Mar 1986. Contract AC22-84PC70815. 32p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86008331.

The report describes the work performed by the three labs involved in the investigation of coal combustion under the TRW contract. The investigation is divided into three tasks. In the first task, coal volatiles combustion is investigated on a flat flame burner at TRW. The burner and the fuel feed system are described. The determination of the chemical rate parameters from the burning velocity as a function of the flame temperature is discussed as well. The second task, determination of global volatile combustion rates in a well stirred reactor, is performed by Ohio State University. The analytical approach to that task is discussed. Finally, char combustion is investigated at Caltech. A description of some preliminary char characterization measurements is given.

25318 **(EPRI-AP—4491) Prediction of emissions and performance of coal liquids in tangential- and wall-fired boilers. Final report.** Dubin, G.W.; Liljedahl, G.N. (Combustion Engineering, Inc., Windsor, CT (USA)). Mar 1986. 358p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI86920229.

Predictions of boiler performance and emissions were made for three distillate products of the Exxon Donor Solvent, H-Coal, and Solvent Refined Coal II processes, when fired in five operating utility boilers. Additionally, predictions with methanol firing were made for three of the units. Two of these boilers were actually tested while firing coal-derived liquid fuels. The other three, much larger units, were selected to be representative of potential substitute fuel conversion candidates. One test boiler was of a wall-fired design and the remaining boilers of tangentially-fired design. Predictions were made for these fuels and the baseline fuels presently in use at each unit for a variety of boiler operating conditions. Computer models of each unit, calibrated to available test data, served as a basis for the predictions. A laboratory analysis of the fuels, performed as part of this study, served to characterize the fuels as input to each model. Although significant deviations were shown to be apparent between predicted and measured performance results for the two field test units, the deviations were explainable. In comparing the predicted fuel to fuel differences to the measured fuel to fuel differences, in general, the predicted trends were verified by the measured field results. Therefore the predictions for the three large units are valid. Predictions of nitrogen oxide emissions were higher for the three large selected units with coal derived liquid firing as compared to the baseline fuels and lower for the methanol. The results were mixed for the test unit predictions. A comparison of the predicted No/sub x/ emissions on the two test units to the actual field test results provides validity to the predictions on the larger units. 9 refs., 146 figs., 56 tabs.

25319 **(IFRF-F—038/a/4) Direct SO/sub 2/ capture by ash or calcium based additive in long pulverised coal flames with flue gas recycling for unwashed and washed French coals. Report on the CdF3 trials.** Thorneycroft, W.S.; Flament, G. (International Flame Research Foundation, Ijmuiden (Netherlands)). Jun 1985. 132p. IFRF, P.O. Box 10000, 1970 CA IJmuiden, Netherlands.

The third experimental phase in a research programme carried out at IJmuiden for Charbonnages de France (CdF) is described. In this phase, two coals mined commercially by CdF in Gardanne and Lorraine were fired with a scaled down version of a parallel flow burner as used in a corner fired boiler in Gardanne. In the two preceding phases, CdF1 and CdF2, it was established that flame temperature has a strong effect upon ash SO/sub 2/ capture levels. In this phase therefore, the peak flame temperature was reduced by the injection of flue gas into the burner air flows (FGR) and the resultant effect upon sulfur retention was assessed. It was found that for a long coal flame ignited by the recirculation of hot furnace gases, application of FGR can produce a marked improvement in sulfur capture levels with either a manufactured sorbent or by ash retention. The distribution of injected flue gases amongst the burner air flows (injection mode) is also a significant factor in modifying capture. Reduction of peak flame temperature by FGR was confirmed as the most probable cause of increased sulfur capture, but if a maximum peak flame temperature of more than 1300°C was generated, after the application of FGR, no significant improvement in sulfur capture, relative to a flame without FGR under similar conditions, could be achieved. (J.C.R.)

25320 **(ORNL/TM—9770) Prospects for coal briquettes as a substitute fuel for wood and charcoal in US Agency for International Development Assisted countries.** Perlack, R.D.; Stevenson, G.G.; Shelton, R.B. (Oak Ridge National Lab., TN (USA)). Feb 1986. Contract AC05-84OR21400. 65p. NTIS, PC A04/MF A01; GPO Dep. File Number DE86007879.

Fuelwood shortages and potential shortages are widespread throughout the developing world, and are becoming increasingly more prevalent because of the clearing of land for subsistence and plantation agriculture, excessive and inefficient commercial timber harvesting for domestic and export construction, and charcoal production to meet rising urban demands. Further, the environmental and socioeconomic consequences of the resulting deforestation are both pervasive and complex. This report focuses on the substitution of coal briquettes for fuelwood. Although substantial adverse health effects could be expected from burning non-anthracite coal or coal briquettes, a well-developed technique, carbonization, exists to convert coal to a safer form for combustion. The costs associated with briquetting and carbonizing coal indicate that "smokeless" coal briquettes can be produced at costs competitive with fuelwood and charcoal. The US Agency for International Development (USAID) is working on implementing this energy option in Haiti and Pakistan by (1) evaluating resources, (2) assessing markets, (3) analyzing technologies, (4) studying government policy and planning, and (5) packaging the idea for the private sector to implement. 26 refs., 2 figs., 12 tabs.

25321 **(STEV-FBA—85-28) Pollution from peat combustion.** Bergstroem, J.; Bjoerner, B.; Oehrstroem, T. (Statens Energiverk, Stockholm (Sweden)). Apr 1984. 134p. (In Swedish). (MKS—85-22). NTIS (US Sales Only), PC A07/MF A01. File Number DE86751544.

The report presents measurements of the air pollutants from seven peat fired boilers. Two of them were circulating and two bubbling fluidized beds. The other three had fire-grates. The flue gas cleaning was carried out by electro filter, electro scrubber, cyclones, and fabric filters. The dust and metal pollution depends

mostly on the gas cleaning equipment. The fabric filter collects more than 99.5% of the dust. The electro scrubber also had a very good efficiency. Only little, max 6%, of the sulfur in the fuel is bound to the ash and slag. Only a few ppm of NO_2 could be measured in the flue gas. The dominating part of nitrogen oxides was NO.

0150 Marketing And Economics

REFER ALSO TO CITATION(S) 25271

25322 (DOE/EIA—0483) Outlook for US coal imports. (USDOE Energy Information Administration, Washington, DC. Office of Coal, Nuclear, Electric and Alternate Fuels). 19 Mar 1986. 72p. NTIS, PC A04/MF A01; 1 - GPO; GPO Dep. File Number DE86008814.

The analysis indicates that both Colombian coal and Canadian coal have the potential to continue to flow into the US domestic market. However, the magnitude of this flow is projected to be small, 4.8 million tons (less than 0.5% of US coal production and less than 4.7% of US coal exports) in 1995, and the projected markets for these imports are quite confined - Colombian coal to Florida and Puerto Rico, and Canadian coal to the west coast. Colombian coal shipments to Florida imply a potential displacement of 2.5 million tons of Kentucky coal supplies, which otherwise would be the most likely domestic source. Colombian coal exports to Puerto Rico imply a displacement of West Virginia coal, which is projected to be the least expensive domestic supply source to Puerto Rico. Coal primarily from Utah and secondarily from Wyoming is projected to be the domestic supply that could be displaced by Canadian coal imports of 1.8 million tons on the west coast. The displaced coal production in these states, however, would represent a small share of the projected increase in coal production between 1985 and 1995. The analysis also indicates that the greatest impact of Colombian coal imports on the US coal supply is expected when world coal demand is weak and absorbs less Colombian coal. 27 tabs.

0160 Health And Safety

REFER ALSO TO CITATION(S) 25290, 25291

25323 (PB—86-136660/XAB) Determination of alpha quartz particle distribution in respirable coal-mine dust samples and reference standards. Rept. of Investigations/1985. Huggins, C.W.; Johnson, S.N.; Segreti, J.M.; Snyder, J.G. (Bureau of Mines, Avondale, MD (USA). Avondale Research Center). 1985. 14p. (BM-RI—8975). NTIS, PC A02/MF A01.

The objective of the Bureau of Mines research was to compare the size distribution of respirable quartz collected at coal mines with that of several reference standards used to quantify quartz in coal-mine dust samples. Particle-size measurements were made on 23 samples and 4 reference standards using a scanning electron microscope in the backscatter electron mode of operation, interfaced with an image-analysis system. The Mine Safety and Health Administration provided the 23 respirable coal-mine dust samples, which were collected at surface and underground coal mines in 7 States.

25324 (PB—86-138930/XAB) Cost benefit analysis of low-coal cabs and canopies. Open File report, 6 July 1981-30 April 1982. Lindahl, P.D.; Whitehead, K.L. (Bituminous Coal Research, Inc., Monroeville, PA (USA)). Nov 1983. 146p. (BCR-L—1298). NTIS, PC A07/MF A01.

A cost-benefit analysis was conducted by comparing the industry cost to install protective structures on low-coal face equipment with the benefits paid for injuries and/or fatalities considered preventable by the use of these structures. The industry costs were based on estimates by original equipment manufacturers and rebuild shops for installing protective structures on new and rebuilt face equipment. The accident benefits were based on evaluations performed by the Bureau of Mines Accident Cost Indicator Model. Industry-wide population data were developed on low-coal face equipment and injuries and/or fatalities preventable with protective structures. The results of the analysis are to be used as a tool by the Bureau of Mines in determining the feasibility of continuing development of cab and canopy technology for low-coal equipment.

25325 (PB—86-138989/XAB) Generalization of medical and health compliance research to coal-mine safety. Open file report, 1 September 1983-28 February 1985. Cole, H.P.; Berger, P.K.; Garrity, T.F.; Auvenshine, C.D.; Szwilski, A.B. (Kentucky Univ., Lexington (USA). Inst. for Mining and Minerals Research). Feb 1985. 207p. NTIS, PC A10/MF A01.

Methods for increasing compliance to medical and health regimens were reviewed along with similar research in industrial and mine safety. Principles abstracted from both areas suggest that compliance with health and safety practices is improved when (1) workers are cooperatively involved with management in setting safety goals and planning for their achievement, (2) the program has the support of workers, supervisors, and management, (3) specific tasks responsible for injuries are targeted, (4) company organizational policy, educational, and behavioral programs work together toward the same goals, (5) workers and supervisors are frequently informed about their degree of correct task performance, and (6) programs are monitored by the frequency of correct performance of targeted tasks (the means to lowered accident rates) rather than by lowered accident and injury rates themselves (the goals for safety programs). Safety programs that incorporate these principles increase person's adherence to specified health and safety practices and subsequently decrease injury rates.

25326 (PB—86-146933/XAB) Demonstration of a mine-shaft fire and smoke-protection system for coal mines. Open File report, December 1979-March 1983. Stevens, R.B. (ESD Corp., San Jose, CA (USA)). Mar 1983. 295p. NTIS, PC A13/MF A01.

The goal of the research was to increase the safety of workers in underground coal mines by developing and in-mine testing a low-cost, available, and flexible fire safety system to reduce the spread of fire and contaminated air in or near mine shafts. The work detailed information on the magnitude of the hazard, industry acceptance of remote data-acquisition systems, and alternative fire-safety systems to meet four different mine profiles. A complete fire reporting system was designed, installed, and in-mine tested at a Midwest underground coal mine from April 1980 to March 1983.

25327 (PNL-SA—12292) Hydrogenated polycyclic aromatic hydrocarbons in coal liquefaction materials: analytical chemistry and biological activity. Later, D.W.; Wozniak, T.J.; Lucke, R.B.; Pelroy, R.A.; Mahlum, D.D.; Hites, R.A. (Pacific Northwest Labs., Richland, WA (USA); Indiana Univ., Bloomington (USA)). Nov 1984. Contract AC02-80EV10449;AC06-76RL01830. 17p. (CONF-8410225—6). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86007738.

From 9. international symposium on polynuclear aromatic hydcarbons; Columbus, OH, USA (30 Oct 1984).

Hydrogenated PAH are major components in coal liquefaction materials that have been processed using catalytic hydrogenation. Hydroaromatic compounds generally exhibit reduced levels of biological activity as compared to their respective parent PAH. Furthermore, complex hydroaromatic isolates from coal liquids are less biologically active than their PAH counterparts. Although the hydroaromatic isolates are frequently much more complex than corresponding PAH fractions, instrumental analytical techniques such as capillary column gas chromatography, mass spectrometry and uv spectrophotometry have been effectively used for compound specific identification of hydroaromatic compounds in complex isolates of coal liquefaction materials. Examples of the utility of these analytical techniques have been given in this paper.

25328 (PNL-SA—12589) Effect of matrix composition on expression of carcinogenic activity of coal liquids. Mahlum, D.D.; Wright, C.W.; Chess, E.K.; Lucke, R.B.; Wilson, B.W. (Pacific Northwest Labs., Richland, WA (USA)). Apr 1985. Contract AC06-76RL01830. 10p. (CONF-841210—31). NTIS, PC A02/MF A01; GPO Dep. File Number DE86007641.

From International chemical congress of Pacific Basin Society; Honolulu, HI, USA (16 Dec 1984).

We have examined a number of coal-derived liquids for their carcinogenic activity in attempts to compare the relative potencies of liquids derived from various processes and identified the components responsible for the carcinogenic activity. Fractionation appeared to increase the activity. Activities of the materials tested did not necessarily reflect the levels of known carcinogens such as benzo[a]pyrene (BaP), nor were they simple summations of the biological activities of individual components. These observations suggest that there are interactions among components of these complex mixtures which influence the response of the animal to the carcinogenic constituents. Data obtained in our laboratory indicate that known mutagens and carcinogens contained in complex mixtures derived from coal may show either suppressed or enhanced activity depending upon the composition of the mixture.

02 PETROLEUM

0203 Drilling And Production

REFER ALSO TO CITATION(S) 26025

25329 (NMERDI—2-72-4216) Enhanced oil recovery by CO_2 foam flooding. Patton, J.T. (New Mexico State Univ., Las Cruces (USA). Dept. of Chemical Engineering). Mar 1986. 204p. NTIS, PC A10/MF A01 - NMERDI Univ. of New Mexico, 457 Washington SE, Albuquerque, NM 87108. File Number DE86901124.

The feasibility of reducing the mobility of carbon dioxide, injected into a petroleum reservoir to enhance oil recovery, has been demonstrated in laboratory models. Effective chemical additives for a wide range of actual field conditions were identified and are now available commercially. Computer simulation of the process indicates oil recovery improvements of 10 to 20% are attainable. 113 refs., 47 figs., 13 tabs.

0205 Products And By-products

REFER ALSO TO CITATION(S) 25827

25330 (AD-A—162244/8/XAB) Antimisting kerosene: development of a continuous 10-gpm inline blender. Final report, August 1983-September 1984. Parikh, P.; Yavrouian, A.; Sarohia, V. (Jet Propulsion Lab., Pasadena, CA (USA)). Oct 1985. 29p. (JPL-PUB-D—2582). NTIS, PC A03/MF A01.

A continuous inline blender was developed at JPL to blend precisely metered quantities of ICI developed polymer slurries into a stream of Jet-A fuel. The inline blender was used to produce 5 to 10 gallons per minute of freshly blended AMK. The proprietary ICI slurries were made of FM-9 type polymers in a glycol/amine carrier fluid. Depending upon the polymer particle size and powder loading, the slurry consistency ranged from free flowing to a paste with viscosities in the range of 5000 to 100,000 centipoise. With one of the polymer slurries, a provision was made for a time delay between the addition of slurry and the addition of the amine sequentially into the Jet-A stream.

25331 (AD-A—163157/1/XAB) Real-time quality control of antimisting kerosene (amk). Final report, February 1983-April 1985. Mannheimer, R.J. (Southwest Research Inst., San Antonio, TX (USA). Belvoir Fuels and Lubricants Research Facility). Oct 1985. 67p. (BFLRF—187). NTIS, PC A04/MF A01.

This report discusses the results of a program to develop real-time quality-control tests for antimisting fuels. In Phase I, dieswell and torsional balance experiments were performed to compare the shear and normal stresses developed by AMK (0.3% FM-9 + glycol/amine in Jet A) and 0.1% ARCO in Jet A. In phase II, experiments were conducted to determine the effect of polymer concentration and methods of blending on the rheological properties of AMK.

25332 (AD-A—163399/9/XAB) Unusual contaminant in JP-4 fuel delivered to Fort Campbell, Fort Knox, and Tennessee Army National Guard. Interim report, April-July 1985. Barbee, J.G.; McInnis, R.S.; Kohl, K.B.; Stavinoha, L.L. (Southwest Research Inst., San Antonio, TX (USA). Belvoir Fuels and Lubricants Research Facility). Nov 1985. 86p. (BFLRF—201). NTIS. PC A05/MF A01.

Many common types of debris were encountered during the course of a recent investigation to identify an unusual contaminant present in jet fuel (JP-4) at three Army locations. Most of the other debris were materials commonly found in fuel samples, e.g. metal flakes, rust, fibers, dirt, etc. Various analytical techniques used in this evaluation indicated that the unusual flake-like organic debris was probably a manmade (synthetic) organic component and not a fuel product. It had a high melting point (>200 C) and was insoluble in most common solvents. The physical appearance of the flakes (thin and flat while floating in the fluid) indicated that the material was originally formed or deposited in a thin layer prior to its introduction into the fuel. The most likely source of a material with these characteristics was an unpigmented paint or protective coating from one of the epoxy or similar resin families. Such a material could be introduced into the fuel by debonding or delamination of the contaminant from any handling, storage, or transportation equipment that contains such a coating. The elements, chemical bonds, and functional groups detected by the various analytical tests were consistent with this conclusion. The use of a light box for enhanced visual (Clean and Bright) evaluation is presented in this report. Also discussed is an approach for isolating similar debris (from fuel) to provide for scanning electron microscopic, Auger, and Electron Spectroscopy for chemical analysis (ESCA) evaluation.

25333 (AD-B—064568/9/XAB) Long-range military implications of petroleum availability for Navy planning study. Wilson, D.P.; O'Neill, T.C. (Center for Naval Analyses, Alexandria, VA (USA). Naval Warfare Analysis Group). Nov 1981. 118p. (CNS—1165). NTIS, PC A06/MF A01.

This study evaluates petroleum issues facing the Navy over the next 20 years. It analyzes the threat of reduced availability of petroleum and the probable effects on naval warfare, on the selection of weapons, and on mobility. There are four areas of investigation: the current oil market, production forecasts, the prospect of import interruptions, and Navy options. The study address the changes in the oil market since the embargo of 1973. It explains how those changes in the market have affected Navy budgets and eroded steaming and flying hours. Published forecasts of lowered production of petroleum and the threat of interruptions of imports are evaluated for their potential to disrupt world markets out to the year 2000. Several aspects of future petroleum supplies are quantified. The study concludes by recommending measures the Navy can take to deal wtih the problems of reduced fuel availability and quality. (Author)

25334 (PB—86-137155/XAB) Underground-tank leak-detection methods: a state-of-the-art review. Final report, July 1984-January 1985. Niaki, S.; Broscious, J.A. (IT Corp., Pittsburgh, PA (USA)). Jan 1986. 137p. NTIS, PC A07/MF A01.

The report is a state-of-the-art review of available and developing methods for finding small leaks in underground storage tanks used primarily for gasoline and other liquid petroleum fuels. This review describes (based on information provided by the manufacturers or practitioners) a total of thirty-six volumetric, nonvolumetric, inventory monitoring, and leak effects monitoring detection methods; provides general engineering comments on each volumetric and nonvolumetric leak-detection method; and discusses variables that may affect the accuracy of detection methods. The empha-

sis throughout is on volumetric and nonvolumetric leak-detection methods.

0206 Health And Safety

25335 (STF—88A82062) Risk of oil and gas blowout on the Norwegian Continental Shelf. Dahl, E.; Bern, T.I.; Golan, M.; Engen, G. (SINTEF, Trondheim (Norway)). Feb 1984. 57p. NTIS (US Sales Only), PC A04/MF A01. File Number DE86751551.

Data from 172 offshore blowouts, which occurred 1956-1980 all over the world, have been collected and analyzed with the purpose to evaluate the relevance of blowout causes to the operations in the North Sea area, and to predict the risk of blowouts on the Norwegian Continental Shelf during the next two decades. Blowouts during drilling/completion/workover are always preceded by a kick, which in 50% of the occurrences was caused by an unexpected high pressure zone, in 28% by swabbing effects and in 9% of the cases by lost circulation. The wells have blown up the annulus, through drillpipe or tubing, through the wellhead or outside the casing. During production 61% of the blowouts came up the tubing through the Xmas tree. On the Norwegian Continental Shelf 6 blowouts are expected to occur during 1981-2000. During the same period there is also reason to expect 3 blowouts from fixed platforms, one of them with fire. According to the estimates 0.4 blowouts will cause considerable oil spills. 4 references.

0207 Marketing And Economics

REFER ALSO TO CITATION(S) 25714

25336 (DOE/EIA—0109(85/12)) Petroleum Supply Monthly, December 1985. (USDOE Energy Information Administration, Washington, DC. Office of Oil and Gas). 25 Feb 1986. 99p. NTIS, PC A05/MF A01; 1 - GPO; GPO Dep. File Number DE86007120.

25337 (DOE/EIA—0109(86/01)) Petroleum Supply Monthly, January 1986. (USDOE Energy Information Administration, Washington, DC. Office of Oil and Gas). 27 Mar 1986. 130p. NTIS, PC A07/MF A01; 1 - GPO; GPO Dep. File Number DE86008556.

US petroleum consumption (measured as product supplied for domestic use) in 1985 remained unchanged from 1984, at 15.7 million barrels per day. The interplay of offsetting factors tended to keep overall petroleum consumption close to the 1984 level. Several factors tended to reduce incentives to conserve petroleum and to increase discretionary and business travel. Other factors served to restrain consumption and keep it at relatively low levels. This article describes the way in which these and other factors have affected consumption of each of the major petroleum products (motor gasoline, distillate fuel oil, residual fuel oil, liquefied petroleum gases, and jet fuel) in recent years. It also discusses factors influencing recent consumption patterns in the transportation, residential/commercial, industrial, and electric utility sectors of the economy.

25338 (DOE/EIA—0380(85/12)) Petroleum Marketing Monthly, December 1985. (USDOE Energy Information Administration, Washington, DC. Office of Oil and Gas). 28 Feb 1986. 164p. NTIS, PC A08/MF A01; 1 - GPO; GPO Dep. File Number DE86007683.

Information and statistical data about a variety of crude oils and refined petroleum products are given. The publication provides crude oil cost statistics and refined petroleum products sales statistics for use by industry, government, private sector analysts, educational institutions, and consumers. Data on crude oil include the domestic first purchase price, the f.o.b. and landed cost of imported crude oil, and the refiners' acquisition cost of crude oil. Sales data for motor gasoline, distillates, residuals, aviation fuels, kerosene, and propane are presented.

25339 (DOE/EIA—0380(86/01)) Petroleum Marketing Monthly, January 1986. (USDOE Energy Information Administration, Washington, DC. Office of Oil and Gas). Jan 1986. 162p. NTIS, PC A08/MF A01; 1 - GPO; GPO Dep. File Number DE86008908.

Information and statistical data about a variety of crude oils and refined petroleum products are given. The publication provides crude oil cost statistics and refined petroleum products sales statistics for use by industry, government, private sector analysts, educational institutions, and consumers. Data on crude oil include the domestic first purchase price, the f.o.b. and landed cost of imported crude oil, and the refiners' acquisition cost of crude oil. Sales data for motor gasoline, distillates, residuals, aviation fuels, kerosene, and propane are presented.

25340 (DOE/EIA—0484(85)) International Energy Outlook 1985. With projections to 1995. (USDOE Energy Information Administration, Washington, DC. Office of Energy Markets and End Use). 19 Mar 1986. 67p. NTIS, PC A04/MF A01; 1 - GPO; GPO Dep. File Number DE86008208.

This report now includes the outlook for international energy markets with the international and individual fuel assessments published separately. This issue emphasizes oil market developments, particularly future world oil prices and oil production potential. This emphasis in no way minimizes the importance of other energy markets; moreover, the analysis recognizes that the development of alternative energy sources impacts directly on the world oil market. The world oil price projections developed in this international setting are, in turn, used as assumptions for analyses of the US domestic energy market provided in the Annual Energy Outlook 1985. Since the US energy market affects and is affected by the international market, the methodology incorporates this interaction to the extent possible. Sources providing more detailed discussions on the US domestic markets are referenced throughout the report.

25341 (DOE/EIA—0486) Futures markets and petroleum supply. A study of heating oil futures. Farmer, R.D. (USDOE Energy Information Administration, Washington, DC. Office of Energy Markets and End Use). 2 Apr 1986. 44p. NTIS, PC A03/MF A01 - GPO; GPO Dep. File Number DE86008898.

The study evaluates the month-to-month performance of the wholesale heating oil market in the East Coast region over the past three winters as influenced by the price of heating oil futures traded on the New York Mercantile Exchange (NYMEX) for New York Harbor delivery. The economic basis for the analysis is derived from a conceptual model of petroleum refiner and marketer behavior. In this model, futures trading and cash market plans are described as being jointly formulated to maximize profits and minimize risk. A comparison of price and inventory levels indicated by the model for a "no futures" and a "futures" case provides an indication of how the introduction of futures trading may have influenced petroleum markets. The study demonstrates that the "no futures" model provides a better explanation of actual cash market prices than does the "futures" model, but that the "futures" model provides a better explanation of inventory levels. Estimates of inventory change support a finding that petroleum suppliers are using futures to manage risk in a manner consistent with the "futures" model described in this paper. The fact that the "no futures" model provides a marginally better explanation of cash prices, however, suggests that risk attitudes still influence the petroleum supply and demand decisions of many market participants. The "no futures" model always performs best when the futures price is used to represent price expectations, underscoring the importance of the futures market as an information source, even to those businesses that do not trade in futures. At the same time, the magnitudes of the differences between the "futures" and the "no futures" estimates of cash prices and primary inventory change are very small, suggesting the overall influence of futures trading on petroleum supply has not been great. This conclusion is consistent with industry reports that refiners are only peripherally in the refined product futures markets.

25342 **(DOE/EP/31046—T1) Logistics of the US strategic petroleum reserve in the world petroleum market, 1990-2000.** (National Research Council, Washington, DC (USA). Energy Engineering Board). 1985. Contract FG01-84EP31046. 142p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE86008551.

The committee found that the current SPR can significantly mitigate the effects of an oil embargo or other supply disruption, depending on its length and severity, through the 1980s. It also found that the United States has sufficient domestic refining capacity to process crude oil from both the reserve and from other domestic sources through 1990. It questioned the ability of the reserve to distribute crude oil by overland routes since two of the three pipeline systems intended for such use have been converted to natural gas. The study found that the SPR sites will lack the capacity to deliver crude oil to barges, tankers, or pipelines at the designed rate of 4.5 million barrels per day (MMB/D) for the completed 750-MMB reserve. The report also pointed to a possible future shortage of US-owned tankers and barges to carry SPR crude oil. Given its analysis of trends in energy demand, production, and transportation, the committee concludes that the reserve will probably be unable to meet a supply disruption in the 1990s without some major modification in its distribution capability and planned mix of refined petroleum products and crude oil.

25343 **(GAO/RCED—85-151) Benefits and limitations of economic policy responses to an oil supply disruption.** (General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div.). 8 Aug 1985. 30p. US General Accounting Office, Document Handlings and Information. Services Facility, P.O. Box 6015, Gaithersburg, MD 20760. File Number TI86900592.

Report to The Honorable Bill Bradley, United States Senate.

Since Congress has shown a continuing concern about DOE's development of an economic response policy, GAO initiated a review of DOE's position and examined several response policies that have been proposed and considered by Congress and the administration. GAO's economic analysis indicates that several response policies (economy-wide or targeted) could offset, to varying degrees, some of the effects of an oil supply disruption, but involve trade-offs or limitations that are discussed in this report. From an administrative standpoint, a block grant policy may warrant advance legislation. Other potential policies such as changes in tax laws would probably be implemented relatively quickly and may not require advance legislation.

25344 **(NP—6901060) Facts and figures: a comparative statistical analysis.** (Organization of the Petroleum Exporting Countries, Vienna (Austria)). Dec 1984. 47p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86901060.

Facts and figures provides a visual representation of key statistics relating to the world energy industry. The contents are reorganized and expanded from the previous one. The booklet is divided into six sections: The first three sections provide a global overview of the industry, highlighting production, consumption and resource availabilities. Sections 4 and 5 relate specifically to OPEC, utilizing information communicated directly to the Secretariat from the 13 Member Countries of the Organization. The last section contains national income, aid and trade comparisons between the industrialized and the developing countries. The sources are listed at the back.

25345 **(NP—6901066) OPEC at a glance.** (Organization of the Petroleum Exporting Countries, Vienna (Austria)). [1986]. 35p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86901066.

Over the 23 years of OPEC's existence, a myth has grown up, fed by misconceptions and distortions of the Organization's policy and intentions. Instead of understanding and accord, there has been suspicion and hostility arising from a lack of knowledge about OPEC and appreciation of its aims and objectives. This booklet is an introduction to the Organization and its Members, why it was formed, what it does, how it works and what its aspirations are. It is hoped that after going through these pages, the reader will come to realize that OPEC stands not just for the Organization of the Petroleum Exporting Countries, but for global co-operation, fairness, economic responsibility and worldwide unity for the common good.

0208 Waste Management

REFER ALSO TO CITATION(S) 25727

0209 Environmental Aspects

REFER ALSO TO CITATION(S) 25839, 26296, 26304

25346 **(PB—86-114949/XAB) Development document for proposed effluent limitations guidelines and new source performance standards for the offshore subcategory of the oil and gas extraction point source category.** (Environmental Protection Agency, Washington, DC (USA). Industrial Technology Div.). Jul 1985. 410p. (EPA/440/1—85/055). NTIS, PC A18/MF A01.

This is Technical support document for Proposed Best Available Technology, Best Convention Technology and New Source Performance Standards, Water Discharge limitations for the Offshore Oil and Gas Industry. Proposed water discharge limitations were published in the Federal Register on August 26, 1985 (50FR 34592-34636).

25347 **(PB—86-114964/XAB) Assessment of environmental fate and effects of discharges from offshore oil and gas operations.** Petrazzuolo, G.; Michael, A.D.; Menzie, C.A.; Cole, R.H.; Rolan, R.G. (Technical Resources, Inc., Rockville, MD (USA)). Aug 1985. 453p. NTIS, PC A20/MF A01.

The overall objectives of this study are to characterize and assess the fate and effects of discharges from offshore oil and gas drilling and production activities. Four specific objectives were outlined by EPA: Present overall conclusions on the fate and effects of drilling fluids and cuttings discharged to the marine environment; Describe types and quantities from offshore drilling and production; Describe transport phenomena to which discharges will be subjected, including physical, chemical, and biological processes; and Present information on the acute and chronic toxicity of drilling fluids and produced waters on marine organisms.

25348 **(PB—86-132388/XAB) Modeling of overland flow by the diffusion-wave approach. Research report.** Govindaraju, R.S.; Jones, S.E.; Kavvas, M.L. (Kentucky Water Resources Research Inst., Lexington (USA)). Aug 1985. 90p. (RR—159). NTIS, PC A05/MF A01.

Water-quality degradation and a need for precise answers to transport of pollutants by overland flow were studied with special reference to the evaporation pits located adjacent to streams in the oil-producing regions of eastern Kentucky. The practical shortcomings of the state-of-the-art kinematic wave are discussed, and a new mathematical-modeling approach for overland flows using the more-comprehensive diffusion wave is attempted as the first step in solving this problem. The physically justified boundary conditions for steep slopes is considered, and both numerical and analytical schemes are developed. Finally, the cases for which these techniques can be used are presented.

25349 **(STF—21A85044) Coastal mapping for oil spill contingency planning. Status as per 1 March 1985.** Klokk, T. (SINTEF, Trondheim (Norway)). Mar 1985. 15p. (In Norwegian). NTIS (US Sales Only), PC A02/MF A01. File Number DE86751553.

The report gives a survey of the program for coastal mapping in Norway, which began in 1981. The background, aim, content, and status of the environmental atlas are presented. 2 drawings, 1 table.

0240 Storage

REFER ALSO TO CITATION(S) 25334

25350 (GAO/RCED—86-84) Oil reserve: status of Strategic Petroleum Reserve activities as of December 31, 1985. (General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div.). Jan 1986. 29p. General Accounting Office, Box 6015, Gaithersburg, MD 20877. File Number TI86901168.

Report to the Chairman, Subcommittee on Environment, Energy, and Natural Resources, Committee on Government Operations, House of Representatives.

This report discusses events and activities related to the administration's progress in filling, developing, and operating the Strategic Petroleum Reserve (SPR) during the first quarter of fiscal year 1986. Specifically, it notes that: DOE added 4.5 million barrels of oil to the SPR, bringing the total to 493.3 million barrels. The oil fill rate averaged about 49,000 barrels per day during the quarter. DOE made payments of $178 million for oil acquisition and transportation, had unpaid obligations of about $140 million, and had about $668 million in unobligated funds. The storage capacity development program proceeded during the quarter; however, the West Hackberry, Louisiana site's leaching program was stopped in December due to a leak in the brine disposal line. DOE held an SPR drawdown test sale and distribution exercise. Approximately 1 million barrels of oil were competitively sold to oil company bidders and subsequently withdrawn from DOE storage sites for delivery. The Congress passed a continuing resolution for fiscal year 1986 providing about $113 million for continued construction of storage capacity as directed by the fiscal year 1985 Supplemental Appropriations Act. On December 27, 1985, DOE formally notified cognizant congressional committees that it was planning to submit a deferral of funds for SPR storage facilities development. This report also presents information on (1) the implementation of recommendations made in the DOE Oak Ridge Operations Office's reports on its baseline assessment of the SPR Project Office and its review of allegations about mismanagement or misconduct within the SPR program, (2) DOE's compliance with the Cargo Preference Act of 1954 during the 1985 crude oil procurement program, (3) DOE's program to analyze the quality of oil in filled storage caverns, and (4) DOE's pipeline construction and marine terminal enhancements to improve the SPR oil distribution system.

0250 Combustion

REFER ALSO TO CITATION(S) 25318, 26173, 26180

03 NATURAL GAS

0302 Geology And Exploration

25351 (DOE/MC/21353—2005) LENDA mathematical methods. Hancock, J.S.; Dean, J.H. (EG and G/Washington Analytical Services Center, Inc., Morgantown, WV (USA)). Jan 1986. Contract AC21-85MC21353. 12p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86001064.

The lens distributional analysis code (LENDA) estimates the sand volume directly accessed and the gas drainage patterns of wells drilled in lenticular sand reservoirs. The gas in these formations is trapped in sand lenses distributed throughout a shale matrix. It is believed that very little gas flows from sand lenses through the shale to other sand lenses. Therefore, only "sand lens clusters" through which the wellbore passes would contribute to gas production. A sand lens cluster is defined as one or more intersecting lenses. The estimates are calculated using minimum error techniques, a method that provides an accurate area-wide estimate of the sand lens distribution; however, the accuracy of the placement or size of any lens will be suspect. The accuracy of the estimates increase as the well-lens intersections are described in more detail, and as the number of well-lens intersections described increases. The size estimate of an individual lens will not be as accurate as the size estimate of a lens cluster. A well that intersects several lens clusters will have a more reliable volume estimate than a well that intersects only one lens cluster. The total sand volume estimate of all wells in the study area will be the most reliable. If certain input parameters are unknown, the information is provided from a data bank. The data bank contains information on lens length-width-thickness ratios, average thicknesses, compass direction length orientations of channel fill, and point bar sand lenses from the Wasatch and Mesaverde formations. The data bank information was parsed from outcrop studies conducted by Knutson. 5 refs., 6 figs.

25352 (SAND—85-2502C) Fracture characteristics and reservoir behavior of stress-sensitive fracture systems in flat-lying lenticular formations. Lorenz, J.C.; Branagan, P.; Warpinski, N.R.; Sattler, A.R. (Sandia National Labs., Albuquerque, NM (USA); CER Corp., Las Vegas, NV (USA)). 1986. Contract AC04-76DP00789. 25p. (CONF-860567—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86007703.

From SPE unconventional gas technology symposium; Louisville, KY, USA (18 May 1986).

A new model suggests that the fracture systems that control permeability in flat-lying fluvial reservoirs are distributed in a continuum of sizes, and occur in subparallel, en echelon patterns. Few high angle "orthogonal" fractures exist because this system is created by high pore pressures and relatively low differential horizontal stresses, rather than by structural deformation. Interfracture communication occurs primarily at infrequent, low-angle intersections of fractures. Vertical continuity of such fractures through a reservoir is commonly limited by the numerous lithologic discontinuities inherent in fluvial sandstones. This type of fracture system has been documented in Mesaverde rocks in the Rulison field of the Piceance Creek basin, northwestern Colorado, by studies of 4300 ft (1310 m) of core from the US Department of Energy's three Multiwell Experiment wells, and by studies of the excellent nearby outcrops. Well test results and geologic data from core and outcrop support the model. The described natural fracture system has a significant effect on production and stimulation. 16 refs., 15 figs., 1 tab.

0303 Drilling, Production, And Processing

25353 (PB—86-125143/XAB) Analysis of eastern Devonian gas shales production data. Annual report, July 1, 1984-June 30, 1985. Gatens, J.M.; Lee, W.J. (Holditch (S.A.) and Associates, Inc., College Station, TX (USA)). Jul 1985. 188p. NTIS, PC A09/MF A01.

Production data from over 500 eastern Devonian Shale gas wells were analyzed to determine reservoir characteristics, identify reservoir characteristics that correlate with well quality, develop analytical tools for studying the Devonian Shales, and study effects of stimulation methods on well quality. Empirical equations, production type curves, and an analytical history-matching scheme were developed to determine reservoir characteristics and predict performance. Preliminary stimulation analysis shows that vertical hydraulic fracturing is the optimal stimulation method in the Devonian Shales if created fractures intersect high-permeability features. If not, radial fracturing may be optimal, assuming sufficient fracture length and conductivity can be achieved in practice.

25354 (PB—86-148632/XAB) Natural gas data needs in a changing regulatory environment. Final report. (National Research Council, Washington, DC (USA)). Sep 1985. 170p. NTIS, PC A08/MF A01.

As a result of the Natural Gas Policy Act of 1978, a large part of natural gas production was decontrolled on January 1, 1985, signalling a notable move toward more freely competitive field markets for natural gas. This move followed instability in international markets in the 1970s and early 1980s combined with shortages in the interstate natural gas market to generate a national debate over the nation's policy of wellhead price controls. At the request of the Energy Information Administration, the panel studied user needs for data on natural gas and cost-effective means for determining whether user needs are being met. As part of its study of user needs, the panel carefully considered cost-benefit analysis and other methods for designing a data collection program, and the report includes the panel's conclusions and recommendations on

those methods. The report also covers data needs involving production and reserves, pipelines, distribution companies and consumers, and energy disruptions. The panel makes recommendations for new data collection programs and for better data management by EIA.

0306 Marketing And Economics

REFER ALSO TO CITATION(S) 25335

25355 **(GAO/RCED—86-12) Natural gas prices. FERC should improve its initial review of pipelines' natural gas costs.** (General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div.). Nov 1985. 43p. General Accounting Office, Box 6015, Gaithersburg, MD 20877. File Number TI86901167.

Report to Congressional requestors.

Residential natural gas prices increased from an average of $2.56 per thousand cubic feet in 1978 to $6.12 in 1984. This increase was largely due to the higher prices that interstate pipeline companies paid for the natural gas they bought and resold. GAO was asked by 17 members of Congress to examine how the Federal Energy Regulatory Commission reviews the major pipeline companies' requests (filings) to change their rates to reflect changes in their natural gas costs. Specifically, GAO was asked to examine whether the filings submitted were complete and consistent and the Commission's analysts appropriately reviewed the filings before they went into effect. GAO found that most of the sample of filings it reviewed were permitted to go into effect, even though they were lacking data elements specified by the Commission. Also, the Commission did not require companies to submit certain information that, in GAO's opinion, was needed to determine compliance with applicable regulations. The Commission has since taken actions to improve the filings' completeness and content. GAO could not measure the appropriateness of the initial analyses of the filings because analysts were not required to - and did not - fully document the scope of their work and the methods used in analyzing the filings. Also, GAO found that, lacking standardized criteria and procedures for reviewing the company filings, the analysts applied inconsistent criteria and review techniques.

0308 Environmental Aspects

REFER ALSO TO CITATION(S) 25346, 25347

0309 Artificial Stimulation

25356 **(DOE/METC—85/4054) Hydraulic fracture model analysis of the MWX stimulation treatments in the paludal interval.** Layne, A. (USDOE Morgantown Energy Technology Center, WV). Aug 1985. 29p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86001042.

Stimulation data that were measured at the Department of Energy's (DOE) Multi-well Experiment (MWX) are being analyzed with the Morgantown Energy Technology Center's (METC's) hydraulic fracture models. The results of the analysis will improve the stimulation technique efficiencies and the predictive capabilities of hydraulic fracture models for low permeability (tight) gas sandstones. Post-stimulation hydraulic fracture predictions that are made with data from the MWX paludal zones 3 and 4 sandstone formations are included in this report. Post-stimulation fracture diagnostics, hydraulic fracture model predictions, and ongoing and future model analyses are presented. Results from reservoir and hydraulic fracture modeling have shown that complex induced fracture behavior exists in tight gas formations. The hydraulic fracture models predict fracture geometries similar to those that are derived from seismic mapping of the induced fracture. However, disagreement between pressures recorded during the treatment and the predicted pressures indicate that significant model improvements are required to predict complex fracture behavior in tight sandstone formations. Stimulation treatments scheduled for the MWX coastal interval will provide additional data for western gas sands (WGS) model analysis and development. 9 refs., 12 figs., 5 tabs.

25357 **(PB—86-136421/XAB) Preliminary economic assessment of the commercial potential for deep-coalbed methane production from the Red Mountain Unit, Piceance Basin, Colorado. Topical report, January-March 1985.** Seccombe, J.C.; Sakashita, B.J. (Resource Enterprises, Inc., Grand Junction, CO (USA)). Jun 1985. 46p. NTIS, PC A03/MF A01.

The Red Mountain Site, leased and operated by Resource Enterprises, Inc. is the focus of a field-oriented R & D project with the objective to develop, improve, evaluate, and communicate the technology required to produce gas from deeply buried coal with reduced uncertainty and increased economic return. This study evaluates the economics of producing the D Coal Seam at the Red Mountain Site based on data acquired under the project and state-of-the-art reservoir and economic models. The results presented in this report are of a theoretical nature and specific to conditions at the site. The findings presented in this study show that it is unlikely that economic production can be obtained at the Red Mountain Unit using conventional hydraulic fracturing techniques. However, the successful development of improved fracturing technology and/or application of novel stimulation methods could result in economic production of deeply buried coal reservoirs.

25358 **(SAND—85-2506C) Tailored-pulse fracturing in cased and perforated boreholes.** Cuderman, J.F. (Sandia National Labs., Albuquerque, NM (USA)). 1986. Contract AC04-76DP00789. 8p. (CONF-860567—4). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86008338.

From SPE unconventional gas technology symposium; Louisville, KY, USA (18 May 1986).

A propellant-based technology, High Energy Gas Fracturing (HEGF), has been applied to fracturing through perforations in cased boreholes. The use of propellants that deflagrate or burn, rather than high-order explosives that detonate, permits controlled buildup of pressure in the wellbore. The key to successful stimulation in cased and perforated wellbores is to control the pressure buildup of the combustion gases to maximize fracturing obtained, without destroying the casing. Eight experiments have been conducted in a tunnel complex at the Department of Energy's Nevada Test Site. This location provided a realistic in situ stress environment (7 MPa [1000 psi] overburden stress) and access for mineback to directly observe fracturing obtained. Primary variables in the experiments include propellant burn rate and amount of propellant used; presence or absence of liquid in the wellbore; in situ stress orientation; and perforation diameter, density, and phasing. Fracture surfaces propagate outward along lines of perforations, then gradually turn toward the hydraulic-fracture direction. Fracture lengths of 3 m (10 ft) or more are observed. It is shown that such fractures, with proper choice of propellant and perforation design, can be created with no attendant casing damage. 6 refs., 6 figs., 2 tabs.

25359 **(SAND—85-2507C) Laboratory studies for the design and analysis of hydraulic fracture stimulations in tight gas reservoirs.** Sattler, A.R.; Hudson, P.J.; Raible, C.J.; Gall, B.L.; Maloney, D.R. (Sandia National Labs., Albuquerque, NM (USA); Dowell Schlumberger (USA); National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA)). 1986. Contract AC04-76DP00789. 15p. (CONF-860567—3). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86007618.

From SPE unconventional gas technology symposium; Louisville, KY, USA (18 May 1986).

Laboratory studies were used as an aid in designing stimulation treatments and to assist in the analysis of production results. These analyses were done in conjunction with coastal zone stimulation operations at the Department of Energy's Multiwell Experiment near Rifle, Colorado. A multitreatment stimulation plan was designed for the coastal zone because of apparent damage to the paludal zone formations in prior stimulation operations. The stimulation plan was made to minimize the use of water-based, gelled fluids. Two small stimulations were performed in the same coastal interval: an unpropped nitrogen gas frac and a propped, nitrogen foam frac. Gas production decreased from that of the gas frac after the nitrogen foam stimulation and formation damage was apparent. The laboratory program was used to (1) aid stimulation design; (2)

help eliminate several possible causes of damage such as permeability degradation in the matrix rock, a gel block in the sand pack, proppant effects, or imbibition of brine from workover operations; and (3) examine the more probable causes, damage that may be centered around fluid effects in the natural fracture system. A unique explanation is not possible because there are some aspects of these damage mechanisms that cannot be verified in the laboratory. However, comparable damage mechanisms that have been seen in cracked core are described. Also, other postulated forms of fluid damage are discussed, largely in terms of natural fractures in core in combination with other measured core properties. 37 refs., 1 fig., 8 tabs.

0310 Legislation And Regulation

REFER ALSO TO CITATION(S) 25354, 25355

0310 Combustion

REFER ALSO TO CITATION(S) 25318, 26180

04 OIL SHALES AND TAR SANDS

0407 Health And Safety

25360 **(LA—10472-MS) Health hazard evaluation and recommended industrial hygiene practices for aboveground oil shale processing.** Brandt, M.T.; Hargis, K.M.; Schulte, H.F. (Los Alamos National Lab., NM (USA)). Jan 1986. Contract W-7405-ENG-36. 206p. NTIS, PC A10/MF A01; 1; GPO Dep. File Number DE86008324.

Specific process unit operations of aboveground oil shale processing are evaluated to identify and characterize potential health hazards that may be associated with those operations. Process operations evaluated include oil shale mining (both surface and underground), shale preparation and handling, retorting, spent shale disposal, retort offgas handling and cleaning, product oil separation and handling, on-site product upgrading and storage, retort water handling and treatment, by-product recovery, and general plant facilities. Situations common to many process units or operations, such as maintenance and confined space/limited egress, are discussed. Recommended industrial hygiene practices are discussed, including engineering controls, industrial hygiene monitoring, worker health training, personal protective equipment, decontamination, employee health surveillance, and recordkeeping. 220 refs., 33 figs., 18 tabs.

0410 Environmental Aspects

25361 **(DOE/ER—0261) Evaluation of the validity and statistical variability of lithium and fluoride distribution coefficient values in a complex geochemical system.** Pavlik, H.F.; Runnells, D.D. (Colorado Univ., Boulder (USA). Dept. of Geological Sciences). Jan 1986. 17p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86008702.

Predictive modeling of solute transport requires accurate measurement or estimation of geochemical adsorption and ion exchange parameters for a given rock-fluid system. One such parameter is the distribution coefficient (Kd) used to predict the rate of movement of dissolved contaminant through soils and aquifers. The Kd describes the partitioning of a dissolved species between a solid phase and the aqueous solution in equilibrium with the solid phase. This research presents a statistical evaluation of the validity of the distribution coefficient to describe adsorption of lithium and fluoride in a complex, natural rock-fluid system. The general goal of the research was to generate Kd parameters appropriate for simulating contaminant migration from oil shale waste disposal sites planned for the Piceance Creek Basin of western Colorado. Specific objectives were to: (1) test the key assumptions that control valid application of the Kd in any rock-fluid system. Included among these are the assumptions that the slope of the partitioning function in constant linear that the choice of solid/solution ratio used in laboratory batch studies has no effect on the Kd determination and that the Kd value is independent of concentration. (2) Determine the statistical variability of Kd values for Li and F obtained in the laboratory and hence provide a confidence interval for Kd values for this rock-fluid system. 7 refs., 2 figs., 5 tabs.

05 NUCLEAR FUELS

0501 Reserves

REFER ALSO TO CITATION(S) 25663

0502 Exploration

REFER ALSO TO CITATION(S) 25663

0504 Feed Processing

REFER ALSO TO CITATION(S) 25431

0506 By-products

25362 **Fuel reprocessing, a unique opportunity to maximize the availability of transuranics.** Eschbach, E.A. (Pacific Northwest Laboratories, Richland, WA). pp 93-104 of Waste management '83. Vol. 2. La Grange Park, IL; American Nuclear Society (1983). (CONF-830205—).

From Waste management conference; Tucson, AZ, USA (27 Feb 1983).

System studies completed in the early Sixties are reviewed so as to provide a "start" for enhancing both incidental and purposeful production of the transuranics by adjusting the fuel cycle, especially fuel exposure, and by avoiding isotopic dilution of recycled uranium and plutonium streams. In addition, production could be increased by appropriately "managing" irradiation of intermediaries that include two or more isotopes of the same element. Attention is also directed towards "indifference" pricing philosophies to result in a stable enterprise even though a sequence of processing and irradiation involving different fiscal enterprises were involved. The "indifference" pricing system avoids both losses and windfalls to the participants. Examination also indicates that a significant reduction could result in the costs of electrical power if a substantial market develops in decay isotopes. The diversion of neutrons from production of fissile fuel to special isotopes appears relatively minor since the major neutron investments are now being made in these isotopes as neutron parasites. Moreover, in view of the long-term development of the breeder and the possible near saturation of the demands for energy, an excess of neutrons will be available beyond the needs to breed fissile fuel. Thus, decay isotopes can be bred and "conversion ratios" for such isotopes are developed. In addition, the technological approaches and pricing methodologies reviewed here can be applied for the extra long-term view involving the production of additional transuranic isotopes from thorium irradiation, both thorium-232 and thorium-230 (Ionium).

25363 **Potential for beneficial use of krypton-85.** Tingey, G.L.; Jensen, G.A.; McClanahan, E.D. (Pacific Northwest Laboratory, Richland, WA). pp 89-92 of Waste management '83. Vol. 2. La Grange Park, IL; American Nuclear Society (1983). (CONF-830205—).

From Waste management conference; Tucson, AZ, USA (27 Feb 1983).

Large quantities of krypton-85 (about 42 MCi) are contained in stored power-reactor fuels and about 1 MCi/year in fuels processed at each of the Savannah River and Hanford defense fuel-processing plants. This nuclear byproduct could be a significant material resource if used in specialized applications. Recently a technique for implanting krypton in a growing sputter-deposited metallic film has been developed. This yields a stable, high-concentration source of krypton-85 which may have applications for small power generators. Metal deposits containing up to 14 atom% have been prepared that would give a heat source of 0.9 W/cm^3 if fully enriched krypton-85 were implanted. Potential applications for up

to 10-W batteries include power for runway lighting and other specialized military applications in remote locations, power for telephone or radiocommunications in the far North, and power for monitoring equipment for tracking animals. Krypton-85 has the advantage of being environmentally the most acceptable heat-producing radioisotope available for power production.

25364 **The potential for large scale uses for fission product xenon.** Rohrmann, C.A. (Pacific Northwest Laboratories, Battelle Memorial Institute). pp 81-88 of Waste management '83. Vol. 2. La Grange Park, IL; American Nuclear Society (1983). (CONF-830205—).

From Waste management conference; Tucson, AZ, USA (27 Feb 1983).

Of all fission products in spent, low enrichment, uranium, power reactor fuels xenon is produced in the highest yield - nearly one cubic meter, STP, per metric ton. In aged fuels which may be considered for processing in the U.S. radioactive xenon isotopes approach the lowest limits of detection. The separation from accompanying radioactive ^{85}Kr is the essential problem; however, this is state of the art technology which has been demonstrated on the pilot scale to yield xenon with pico-curie levels of ^{85}Kr contamination. If needed for special applications, such levels could be further reduced. Environmental considerations require the isolation of essentially all fission product krypton during fuel processing. Economic restraints assure that the bulk of this krypton will need to be separated from the much more voluminous xenon fraction of the total amount of fission gas. Xenon may thus be discarded or made available for uses at probably very low cost. In contrast with many other fission products which have unique radioactive characteristics which make them useful as sources of heat, gamma and x-rays and luminescence as well as for medicinal diagnostics and therapeutics fission product xenon differs from naturally occurring xenon only in its isotopic composition which gives it a slightly higher atomic weight, because of the much higher concentrations of the ^{134}X and ^{136}Xe isotopes. Therefore, fission product xenon can most likely find uses in applications which already exist but which can not be exploited most beneficially because of the high cost and scarcity of natural xenon. Unique uses would probably include applications in improved incandescent light illumination in place of krypton and in human anesthesia.

25365 **The Byproducts Utilization Program sewage sludge irradiation project.** McMullen, W.H. (U.S. Department of Energy, Albuquerque Operations Office, Albuquerque, NM). pp 67-72 of Waste management '83. Vol. 2. La Grange Park, IL; American Nuclear Society (1983). (CONF-830205—).

From Waste management conference; Tucson, AZ, USA (27 Feb 1983).

The use of the Department of Energy (DOE) defense byproduct cesium-137 to irradiate municipal sewage sludge and destroy harmful pathogenic organisms is a major thrust of DOE's Byproduct Utilization Program. Research, pilot demonstration and activities to transfer the technology to the commercial wastewater treatment sector constitute DOE's strategy for this byproduct use. Recent efforts are directed at successful technology transfer with DOE support of a full-scale cesium sludge irradiator in Albuquerque, New Mexico.

25366 **Applications developed for byproduct ^{85}Kr and tritium.** Remini, W.C.; Case, F.N.; Haft, K.W.; Tiegs, S.M. (Office of Defense Waste and Byproducts Management, U.S. Department of Energy, Washington, DC). pp 77-80 of Waste management '83. Vol. 2. La Grange Park, IL; American Nuclear Society (1983). (CONF-830205—).

From Waste management conference; Tucson, AZ, USA (27 Feb 1983).

The radionuclides, krypton-85 and tritium, both of which are gasses under ordinary conditions, are used in many applications in industries and by the military forces. Krypton-85 is produced during the fissioning of uranium and is released during the dissolution of spent fuel elements. It is a chemically inert gas that emits 0.695 Mev beta rays and a small yield of 0.54 Mev gammas over a half life of 10.3 years. Much of the ^{85}Kr currently produced is released to the atmosphere; however, large scale reprocessing of fuel will require collection of the gas and storage as a waste product. An alternative to storage is utilization, and since the chemical and radiation characteristics of ^{85}Kr make this radionuclide a relatively low hazard from the standpoint of contamination and biological significance, a number of uses have been developed. Tritium is produced as a byproduct of the nuclear weapons program and it has a half life of 12.33 years. It has a 0.01861 Mev beta emission and no gamma emission. The absence of a gamma ray energy eliminates the need for external shielding of the devices utilizing tritium, thus making them easily transportable. Many of the applications require only small quantities of ^{85}Kr or tritium; however, these uses are important to the technology base of the nation. A significant development that has the potential for beneficial utilization of large quantities of ^{85}Kr and of tritium involves their use in the production of low-level lighting devices. Since these lights are free from external fuel supplies, have a long half life ($\geqq$ 10 years), are maintenance free, reliable, and easily deployed, both military and civilian airfield lighting applications are being studied.

0508 Spent Fuels Reprocessing

REFER ALSO TO CITATION(S) 25407, 25640, 25858, 25953

25367 **Some implications of batch average burnup calculations on predicted spent fuel compositions.** Alexander, C.W.; Croff, A.G. (Chemical Technology Division, Oak Ridge National Laboratory, Oak Ridge, TN). pp 535-540 of Waste isolation in the US, technical programs and public education. Vol. 1. La Grange Park, IL; American Nuclear Society (1984). (CONF-840307—).

From Waste management '84; Tucson, AZ, USA (11 Mar 1984).

The accuracy of using batch-averaged burnups to determine spent fuel characteristics (such as isotopic composition, activity, etc.) was examined for a typical pressurized-water reactor (PWR) fuel discharge batch by comparing characteristics computed by (a) performing a single depletion calculation using the average burnup of the spent fuel and (b) performing separate depletion calculations based on the relative amounts of spent fuel in each of twelve burnup ranges and summing the results. The computations were done using ORIGEN 2. Procedure (b) showed a significant shift toward a greater quantity of the heavier transuranics, which derive from multiple neutron captures, and a corresponding decrease in the amounts of lower transuranics. Those characteristics which derive primarily from fission products, such as total radioactivity and total thermal power, are essentially identical for the two procedures. Those characteristics that derive primarily from the heavier transuranics, such as spontaneous fission neutrons, are underestimated by procedure (a).

0509 Transport And Storage

REFER ALSO TO CITATION(S) 25379, 25966

25368 **(IAEA-AG—406) Third meeting of the advisory group for the comprehensive review of the IAEA regulations for the safe transport of radioactive materials, Vienna, 7-11 November 1983.** Rawl, R.R. (International Atomic Energy Agency, Vienna (Austria)). 1983. 130p. (CONF-8311159—). NTIS (US Sales Only), PC A07/MF A01. File Number DE86701445.

From 3. meeting of the advisory group on the comprehensive review and revision of the regulations for the safe transport of radioactive material; Vienna, Austria (7 Nov 1983).

This meeting was the third and final planned stage in the process to revise the Agency's Regulations for the Safe Transport of Radioactive Materials, Safety Series No. 6. Its task was to consider comments which had been submitted in response to the Agency's circulation of the third draft revision of Safety Series No. 6 and to make any necessary changes to the draft that the Advisory Group felt were necessary.

25369 **(IAEA-AG—445) Advisory group on the explanation and application of the Agency's transport regulations, Vienna, 21-25 May 1984.** O'Sullivan, R. (International Atomic Energy Agency, Vienna (Austria)). May 1984. 168p. (CONF-8405378—). NTIS (US Sales Only), PC A08/MF A01. File Number DE86701446.

From Advisory group on the explanation and application of the agency's transport; Vienna, Austria (21 May 1984).

Advisory Group AG-445 charged with the task of initiating development of new explanatory and advisory material on the revised Agency's Regulations for the Safe Transport of Radioactive Material, Safety Series No. 6. The eventual products of this activity will take the form of new editions of Safety Series No. 7 and No. 37.

25370 **(IAEA-TECDOC—354) IAEA spent fuel storage glossary.** (International Atomic Energy Agency, Vienna (Austria)). Oct 1985. 32p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86701447.

The aim of this glossary is to provide a basis for improved international understanding of terms used in the important area of spent fuel storage technology. The glossary is the product of an IAEA Consultant Group with valuable input from a substantial list of reviewers. The glossary emphasizes fuel storage relevant to power reactors, but is also widely applicable to research reactors. The intention is to define terms from current technologies. Terms are limited to those directly related to spent fuel storage.

25371 **(UCRL—94028) Application of DYNA3D in large scale crashworthiness calculations.** Benson, D.J.; Hallquist, J.O.; Igarashi, M.; Shimomaki, K.; Mizuno, M. (Lawrence Livermore National Lab., CA (USA); Suzuki Motor Co. Ltd., Shizuoka (Japan)). 1986. Contract W-7405-ENG-48. 9p. (CONF-860727—2). NTIS, PC A02. File Number DE86008691.

From Computers in engineering conference; Chicago, IL, USA (20 Jul 1986).

This paper presents an example of an automobile crashworthiness calculation. Based on our experiences with the example calculation, we make recommendations to those interested in performing crashworthiness calculations. The example presented in this paper was supplied by Suzuki Motor Co., Ltd., and provided a significant shakedown for the new large deformation shell capability of the DYNA3D code. 15 refs., 3 figs.

25372 **A bounding assessment method for correlating measured gas leaks to the possible loss of particulate contents from radioactive materials packages.** Andersen, J.A. (Sandia National Labs., Div. 5161, P.O. Box 5800, Albuquerque, NM). *Nuclear Technology;* 72: No. 1, vp(Jan 1986). Contract AC04-76DP00789.

A method is presented for correlating a tracer gas leakage rate to the potential particulate radioactive material (RAM) release from packages for the shipment of RAM, for those cases where a gas leak measurement is used and there is no measurable particulate release. The correlation method involves a calculational technique relating the measured gas leakage to capillary flow, then to the design and dimensions of the actual seal, and then to the minimum size of the particulate material being contained. Numerous examples are cited. This method is useful both in the evaluation of results obtained during regulatory-required testing, and in the process of applying for package certification or licensing. It is indicated that relatively large measured leaks in containment vessels may be analogous to extremely small defects in the actual seal, and to minute releases of RAM.

25373 **Near-term decay heat and age of spent fuel in commercial power reactor inventories.** Libby, R.A.; Holter, G.M. (Pacific Northwest Laboratory, Richland, WA). pp 489-494 of Waste isolation in the US, technical programs and public education. Vol. 1. La Grange Park, IL; American Nuclear Society (1984). (CONF-840307—).

From Waste management '84; Tucson, AZ, USA (11 Mar 1984).

Projections based upon utility supplied data indicate that several commercial nuclear power reactors will require additional spent fuel storage capacity. These storage needs are beyond those which currently exist in the reactor spent fuel storage pools. A key parameter needed to design out-of-pool or consolidated storage capacity to handle these needs is the decay heat of the spent fuel to be stored. Calculations of the heat of the additional spent fuel requiring storage have been made. These calculations indicate small differences in the decay heat of the selected fuel assemblies depending upon whether the oldest or the coldest fuel in the existing inventory is selected first for out-of-pool or consolidated storage.

25374 **Low-cost concepts for dry transfer of spent fuel and waste between storage and transportation casks.** Schneider, K.L. (Pacific Northwest Laboratory, Richland, WA). pp 507-512 of Waste isolation in the US, technical programs and public education. Vol. 1. La Grange Park, IL; American Nuclear Society (1984). (CONF-840307—).

From Waste management '84; Tucson, AZ, USA (11 Mar 1984).

The federal government may provide interim storage for spent fuel from commercial nuclear power reactors that have used up their available storage capacity. One of the leading candidate concepts for this interim storage is to place spent fuel in large metal shielding casks. The Federal Interim Storage (FIS) site may not have the capability to transfer spent fuel from transportation casks to storage casks and vice versa. Thus, there may be an incentive to construct a relatively inexpensive but reliable intercask transfer system for use at an FIS site. This report documents the results of a preliminary study of preconceptual design and analysis of four intercask transfer concepts. The four concepts are: a large shielded cylindrical turntable that contains an integral fuel handling machine (turntable concept); a shielded fuel handling machine under which shipping and storage casks are moved horizontally (shuttle concept); a small hot cell containing equipment for transferring fuel betwee shipping and storage casks (that enter and leave the cell on carts) in a bifurcated trench (trench concept) and a large hot cell, shielded by an earthen berm, that houses equipment for handling fuel between casks that enter and leave the cell on a single cart (igloo concept). Information derived for each of the concepts is operating, capital and relocation costs; implementation and relocation time requirements; and overall characteristics.

0510 Marketing And Economics

REFER ALSO TO CITATION(S) 25389, 25416

0520 Waste Management

REFER ALSO TO CITATION(S) 25362, 25363, 25364, 25365, 25366, 25432, 25433, 25437, 25873, 25874, 25875, 25890, 25894, 25896, 25950, 26116, 26374, 26375, 26377, 26378, 26381, 26382, 26383

25375 **(AD-A—161865/1/XAB) Cementitious mixtures for sealing evaporite and clastic rocks in a radioactive-waste repository. Final report.** Wakeley, L.D.; Roy, D.M. (Army Engineer Waterways Experiment Station, Vicksburg, MS (USA). Structures Lab.). Sep 1985. 19p. (WES/MP/SL—85-16). NTIS, PC A02/MF A01.

Cement-based mixtures were proportioned for sealing a potential geologic repository for high-level radioactive waste in evaporite and related rock strata. The slightly expansive cementitious mixtures were based on Class H portland cement and Class C fly ash, with silica flour and calcium sulfate additives, and a low ratio of water to cementitious solids (w/s = 0.32). Both a salt-free and a salt-containing version were used in tests with anhydrite, siltstone, and halite. Although it is difficult to achieve strong bonding between anhydrite and cement-based mixtures, tensile bond strengths, interface permeability, and other properties of the composites as a whole indicate achievement of the desired chemical and physical compatibility between these materials. Integrity of bonding and low permeability to water (on the order of 0.000001 darcy) suggest the likelihood of attaining durable sealing of repository access shafts and boreholes through the use of such chemically tailored cementitious mixtures. Rock samples used in these sealing studies were obtained from various areas throughout the United States. The data in

the present paper represent results for rocks obtained from the Palo Duro Basin, TX, and, as such, typify bedded-salt strata.

25376 (CONF-850314—Vol.1, pp 61-62) **Underground exploration of the Gorleben salt dome: a status report.** Gruebler, G.; Pitz, W. (Deutsche Gesellschaft zum Bau und Betrieb von Endlagern fuer Abfallstoffe mbH (DBE), Peine, Germany). Apr 1985. Arizona Board of Regents, Tucson, AZ. File Number TI85015356.

From Waste management '85; Tucson, AZ, USA (24 Mar 1985).

The exploration of the Gorleben salt dome for the disposal of all types of radioactive wastes is well in progress. The exploration from the surface is finished. The results of this research and development program have led the German Federal Government to approve the excavation of two exploratory shafts for investigating the salt rock formation of the Gorleben underground. The shafts will be sunk by the ground freezing method. Drilling operations for the freezing process started in May 1984, and the surface facilities have been under construction since early 1984.

25377 (CONF-850513—5) **Anaerobic digestion of cellulosic wastes.** Lee, D.D.; Donaldson, T.L. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 18p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86008985.

From Symposium on biotechnology for fuels and chemicals; Gatlinburg, TN, USA (13 May 1985).

Anaerobic digestion is a potentially attractive technology for volume reduction of low-level radioactive cellulosic wastes. A substantial fraction of the waste is converted to off-gas and a relatively small volume of biologically stabilized sludge is produced. Process development work has been completed using a 75-L digester to verify rates and conversions obtained at the bench scale. Start-up and operating procedures have been developed, and effluent was generated for characterization and disposal studies. Three runs using batch and fed-batch conditions were made lasting 36, 90, and 423 d. Solids solubilization rates and gas production rates averaged approximately 1.8 g cellulose per L of reactor per d and 1.2 L of off-gas per L reactor per d. Greater than 80% destruction of the volatile suspended solids was obtained. A simple dynamic process model was constructed to aid in process design and for use in process monitoring and control of a large-scale digester.

25378 (DOE/NE/44139—T2) **West Valley Demonstration Project annual report.** (West Valley Nuclear Services Co., Inc., West Valley, NY (USA)). Jan 1986. Contract AC07-81NE44139. 34p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86007744.

In FY 1985 the most challenging goal of the Project to date, the start of verification testing of major subsystems of the Vitrification System, was accomplished. Individual testing of subsystems was completed in FY 1985 allowing for the start of integrated testing of all major portions of the Vitrification System. Other accomplishments during this period included completion of cleanup of the first of several former reprocessing cells, the first phase of testing and operation of the system which will solidify low-level liquid wastes and the beginning of construction to support installation of the Supernatant Treatment System which will be used to remove the radioactive fission products from the supernatant.

25379 (DOE/RW—0004/2) **Office of Civilian Radioactive Waste Management annual report to Congress.** (USDOE Office of Civilian Radioactive Waste Management, Washington, DC). Mar 1986. 52p. NTIS, PC A04/MF A01; GPO Dep. File Number DE86008485.

This is the third annual report on the activities and expenditures of the Office of Civilian Radioactive Waste Management (OCRWM) and covers the period from October 1, 1984 through September 30, 1985. The following were among the most significant accomplishments during FY 1985: publication of the mission plan; creation of a systems integration capability; publication of draft environmental assessments; development of a program management system and implementation of a comprehensive approach of "managing for quality" in all program activities; and development of new initiatives and more consistent interactions in the area of institutional relationships. The Office's financial statements for fiscal years 1984 and 1985 are included, and a concluding chapter updates the report with a brief summary of highlights of accomplishments following the end of fiscal year 1985. 96 refs., 10 figs., 5 tabs.

25380 (DOE/RW—0030) **Implementation strategy for the Civilian Radioactive Waste Management Program.** (USDOE Office of Civilian Radioactive Waste Management, Washington, DC). Sep 1985. 20p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86008109.

This document summarizes the DOE's strategy for the implementation of the provisions of the Nuclear Waste Policy Act of 1982. It is largely adapted from Chapter 3 of Part I of the Mission Plan for Civilian Radioactive Waste Management Program (DOE/RW-005) which was published in June 1985. Further details concerning this strategy and the Civilian Radioactive Waste Management Program can be found in the Mission Plan.

25381 (DP-MS—85-104) **Electrolytic denitrification of alkaline nitrate and nitrite solution.** Hobbs, D.T.; Ebra, M.A.; Mindler, A.B. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.; International Hydronics Corp., Rocky Hill, NJ (USA)). 1986. Contract AC09-76SR00001. 17p. (CONF-860317—36). NTIS, PC A02/MF A01; GPO Dep. File Number DE86008906.

From Waste management '86; Tucson, AZ, USA (2 Mar 1986).

Processing of high-level waste at the Savannah River Plant (SRP) will produce a low-level alkaline salt solution, containing approximately 17% sodium nitrate and sodium nitrite. This solution will be incorporated into a cement wasteform, saltstone, and placed in an engineered landfill. Laboratory experiments have demonstrated the technical feasibility of electrochemically reducing the nitrate and nitrite in a synthetic, nonradioactive salt solution similar in composition to that expected to be produced at SRP. Greater than ninety-five percent of the sodium nitrate and sodium nitrite can be reduced electrolytically, producing ammonia, nitrogen, oxygen, and sodium hydroxide. Reduction of the nitrate and nitrite will reduce the leaching of nitrate and nitrite from the saltstone monolith. In addition, significant reductions in the volume of saltstone may be realized if the sodium hydroxide produced by electrolysis can be recycled.

25382 (EGG-WM—7152) **Transuranic Waste Management Program and Facilities.** Clements, T.L. Jr.; Cook, L.A.; Stallman, R.M.; Hunter, E.K. (EG and G Idaho, Inc., Idaho Falls (USA); USDOE Idaho Operations Office, Idaho Falls). Feb 1986. Contract AC07-76ID01570. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86009094.

Since 1954, defense-generated transuranic (TRU) waste has been received at the Radioactive Waste Management Complex (RWMC) at the Idaho National Engineering Laboratory (INEL). Prior to 1970, approximately 2.2 million cubic feet of transuranic waste were buried in shallow-land trenches and pits at the RWMC. Since 1970, an additional 2.1 million cubic feet of waste have been retrievably stored in aboveground engineered confinement. A major objective of the Department of Energy (DOE) Nuclear Waste Management Program is the proper management of defense-generated transuranic waste. Strategies have been developed for managing INEL stored and buried transuranic waste. These strategies have been incorporated in the Defense Waste Management Plan and are currently being implemented with logistical coordination of transportation systems and schedules for the Waste Isolation Pilot Plant (WIPP). The Stored Waste Examination Pilot Plant (SWEPP) is providing nondestructive examination and assay of retrievably stored, contact-handled TRU waste. Construction of the Process Experimental Pilot Plant (PREPP) was recently completed, and PREPP is currently undergoing system checkout. The PREPP will provide processing capabilities for contact-handled waste not meeting WIPP-Waste Acceptance Criteria (WAC). In addition, ongoing studies and technology development efforts for managing the TRU waste such as remote-handled and buried TRU waste, are being conducted.

25383 **(ENEA-RT-COMB—84-3) Treatment of low alpha activity liquid wastes. Preliminary results relating to biological denitrification.** Nannicini, R.; Ramadori, R.; Fenoglio, F.; Pozzi, L. (ENEA, Rome (Italy); AGIP Nucleare, Milan (Italy)). 1984. 19p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701439.

The nuclear industry considers such big safety problems that the purifying treatment of liquid wastes must always provide for a complete recycle of the liquid streams from the production processes as regard this problem. "Enea-Comb-Ifec" people from Saluggia, already previously engaged with verifying and setting-up "Sol-Gel" process for the recovery of uranium-plutonium solutions coming from irradiated fuel reprocessing, started an experimental work with the assistance of "Cnr-Irsa" from Rome on the applicability of the biological treatment to the purification of liquid wastes coming from the production process itself. The present technical report gives, besides a short description of the "Sol-Gel" process, the first results, only relating to the biological stage of the whole proposed purifyng treatment, included the final results of the experimental work, object of a contract between "Enea-Ifec" and "Snam progetti" from Fano.

25384 **(ENEA-RT-COMB—84-7) Leaching of borosilicate glasses incorporating H.L. radioactive wastes. Italian participation in the EEC international Round Robin Test.** Cantale, C.; Donato, A.; Ricci, G.; Basili, N.; Biancifiori, M.A.; Zappa, G. (ENEA, Rome (Italy)). 1984. 35p. (In Italian). NTIS (US Sales Only), PC A03/MF A01. File Number DE86701639.

The European Community Commission organized in the period 1983-1984 an International Round Robin Test aiming at the evaluation of a method for controlling the high-temperature leaching resistance of borosilicate glasses incorporating high-level radioactive wastes. The Radwaste Experimental Processes Laboratory of the COMB/MEPIS Division, in collaboration with the Analytical Chemistry Laboratory of the TIB/CHI Division, participated to this round robin test with other 12 European and 2 extra European laboratories. In this paper the main results obtained in this participation are reported.

25385 **(KFK—3953) Corrosion investigations of selected container materials for HLW disposal in rock salt formations.** Smailos, E. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Nukleare Entsorgungstechnik). Oct 1985. 35p. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number DE86751103.

In safety analyses for a repository in rock salt also the ingress of brines during the post-operational phase and their contact with the waste forms is postulated. To provide an additional protection of HLW forms against radionuclide mobilization by attack of corrosive salt brines, the possibility of using a corrosion resistant packaging as a barrier during the high temperature phase (> 100°C) in the HLW disposal area is being investigated. This report describes the results of long-term immersion tests on the corrosion behaviour of the selected materials Ti 99.8-Pd, Hastelloy C4, fine-grained structural steel and cast steel, in a $MgCl_2$-rich quinary brine (Q-brine). The investigated parameters were: temperature (90°C, 170°C, 200°C), pressure (0,9 MPa, 13 MPa), gamma radiation (10^5 rad/h), and specimen-surface to medium-volume ratio (S/V = 1 $cm^2/5$ cm^3, 1 $cm^2/30$ cm^3, 1 $cm^2/60$ cm^3). Among the materials studied, Ti 99.8-Pd exhibits the highest corrosion resistance. After testing of about 600 days this material corroded at a very low rate (< 1 μma) both with and without gamma-irradiation and has so far proved resistant to local corrosion and stress corrosion cracking. Hastelloy C4 has also resisted pitting corrosion and stress corrosion cracking, in the absence of irradiation, and its corrosion rate has been low at all testing temperatures (> 1 μm/a), but it has been attacked by crevice corrosion. When it was exposed to irradiation (90°C), considerable pitting corrosion was observed in addition to crevice corrosion and an increase in the corrosion rate (2.3 μm/a). By using Hastelloy C4 the container should be adequatly shielded against gamma radiation. The two unalloyed steels have resisted local corrosion and stress corrosion cracking in Q-brine without irradiation. (orig./GL).

25386 **(KURRI-TR—255) Management of radioactive liquid and solid wastes in Research Reactor Institute, Kyoto University, 4.** Tsutsui, Tenson; Shimoura, Kazukuni; Koyama, Akio. (Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst.). Oct 1984. 28p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. File Number DE86701638.

The management of radioactive liquid and solid wastes are reviewed at the Research Reactor Institute, Kyoto University during the past 7 years from April in 1977 to March in 1984.

25387 **(LA—10576-MS) Consolidation and shear failure leading to subsidence and settlement. Final report.** Abeele, W.; Nyhan, J.W.; Hakonson, T.E.; Drennon, B.J.; Lopez, E.A.; Herrera, W.J.; Langhorst, G.J.; Martinez, J.L.; Trujillo, G. (Los Alamos National Lab., NM (USA)). Feb 1986. Contract W-7405-ENG-36. 94p. NTIS, PC A05/MF A01; GPO Dep. File Number DE86008575.

Subsidence and settlement are phenomena that are much more destructive than generally thought. In shallow land burials they may lead to cracking of the overburden and eventual exposure and escape of waste material. The primary causes are consolidation and cave-ins. Laboratory studies performed at Los Alamos permit us to predict settlement caused by consolidation or natural compaction of the crushed tuff overburden. We have also investigated the shear failure characteristics of crushed tuff that may lead to subsidence. Examples of expected settlement and subsidence are calculated based on the known geotechnical characteristics of crushed tuff. The same thing is done for bentonite/tuff mixes because some field experiments were performed using this additive (bentonite) to reduce the hydraulic conductivity of the crushed tuff. Remedial actions, i.e., means to limit the amount of settlement, are discussed. We finally discuss our field experiment, which studies the influence of subsidence on layered systems in general and on biobarriers in particular. The share of the produced cavities is compared with cavities produced by idealized voids in an idealized environment. Study of root penetration at subsidence sites gives us an indication of the remaining degree of integrity. 30 refs., 24 figs., 19 tabs.

25388 **(NUREG/CR—4236-Vol.3) Progress in evaluation of radionuclide geochemical information developed by DOE high-level nuclear waste repository site projects. Report for April-June 1985. Volume 3.** Kelmers, A.D.; Arnold, W.D.; Blencoe, J.G.; Meyer, R.E.; Jacobs, G.K.; Whatley, S.K. (Oak Ridge National Lab., TN (USA)). Feb 1986. Contract AC05-84OR21400. 21p. (ORNL/TM—9614-Vol.3). NTIS, PC A02/MF A01 - GPO. File Number TI86007202.

Geochemical information relevant to the potential mobility of radionuclides at the Hanford Site and the Yucca Mountain site, candidate sites for high-level nuclear waste geologic repositories being developed by Department of Energy projects, is being evaluated by Oak Ridge National Laboratory (ORNL) for the US Nuclear Regulatory Commission. Neptunium(V) sorption isotherms in three different basalt/synthetic groundwater systems were initiated this quarter. Uranium(VI) sorption isotherms were completed with McCoy Canyon basalt and synthetic groundwater GR-2. The control of U(VI) solutions at a level of $\sim 10^{-4}$ mol/L is apparently dominated by the precipitation of sodium boltwoodite. Different apparent concentration limits for uranium were obtained with GR-2 and GR-4 solutions. The results suggest that uranium sorption/solubility behavior could be substantially different in the various basalt units likely to be encountered by groundwater during migration from the waste package to the accessible environment. The EQ3/6 software package was implemented and tested on the ORNL computer system. 13 refs., 2 figs., 1 tab.

25389 **(NUREG/CR—4555) Generic cost estimates for the disposal of radioactive wastes.** Sciacca, F.; Shaffer, C.; Simpkins, B.; Cohen, S.; Goldin, D.; Goldin, A. (Science and Engineering Associates, Inc., Albuquerque, NM (USA)). Mar 1986. 192p. NTIS, PC A09/MF A01 - GPO. File Number TI86901154.

NRC regulatory impact analyses address the costs and benefits associated with proposed regulatory requirements. Many of these requirements will result in physical modifications to existing

structures and systems at nuclear power plants. This report provides a methodology and data needed to estimate the generic costs of disposing of radioactive wastes that may be generated as a result of NRC regulations requiring modifications or repairs to nuclear facilities. Also presented are descriptions of typical low-level radwastes generated at nuclear power plants and the various processes used to treat the wastes in preparation for shipment and burial. The waste disposal cost estimates included in this report cover all of the major elements that contribute to the overall costs. The key factors that influence the costs are discussed. pertinent ranges of values for the key variables are explored and important sensitivities identified. Occupational radiation exposure associated with in-plant handling of the wastes is also discussed.

25390 **(ORNL/TM—9874) ORNL Solid Waste Storage Area 6 trench photos and geologic descriptions, July 1984-September 1985.** Davis, E.C.; Marshall, D.S.; Stansfield, R.G.; Dreier, R.B. (Oak Ridge National Lab., TN (USA)). Mar 1986. Contract AC05-84OR21400. 74p. NTIS, PC A04/MF A01; GPO Dep. File Number DE86008471.

Environmental Sciences Division Publication No. 2636.

The Environmental Sciences Division of the Oak Ridge National Laboratory has initiated a photographic and descriptive geologic study of low-level waste trenches opened in Solid Waste Storage Area 6 (SWSA-6). From July 1984 through September 1985, trenches were excavated, geologically described, and photographed before being filled and closed. Only three trenches (Nos. 438, 448, and 465) were excavated and closed before photography could be scheduled. It is recommended that the systematic trench characterization procedure outlined in this report be continued under the direction of ORNL's Operations Division with support from both Environmental Sciences and the Engineering divisions. Publication of such a compilation of trench photos on a yearly basis will serve not only as a part of Department of Energy trench documentation requirements but also as a component of a SWSA-6 geologic data base being developed for current research and development activities. 2 refs., 38 figs.

25391 **(ORNL/TM—9955) Concepts involved in a proposed application of uncertainty analysis to the performance assessment of high-level nuclear waste isolation systems.** Maerker, R.E. (Oak Ridge National Lab., TN (USA)). Mar 1986. Contract AC05-84OR21400. 30p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86008477.

This report introduces the concepts of a previously developed methodology which could readily be extended to the field of performance assessment for high-level nuclear waste isolation systems. The methodology incorporates sensitivities previously obtained with the GRESS code into an uncertainty analysis, from which propagated uncertainties in calculated responses may be derived from basic data uncertainties. Following a definition of terms, examples are provided illustrating commonly used conventions for describing the concepts of covariance and sensitivity. Examples of solutions to problems previously encountered in related fields involving uncertainty analysis and use of a generalized linear least-squares adjustment procedure are also presented. 5 refs., 14 tabs.

25392 **(PB—86-144268/XAB) Opinions of Pennsylvanians on policy issues related to low-level radioactive waste disposal. Executive summary. Report for July-September 1985.** Bord, R.J. (Pennsylvania State Univ., University Park (USA). Inst. for Research on Land and Water Resources). 1985. 5p. NTIS, PC A02/MF A01.

The executive report is a summary of the results of a survey of the general public and influential citizens concerning their opinions on various low-level radioactive waste-disposal issues.

25393 **(PB—86-144276/XAB) Opinions of Pennsylvanians on policy issues related to low-level radioactive waste disposal. Report for July-September 1985.** Bord, R.J. (Pennsylvania State Univ., University Park (USA). Inst. for Research on Land and Water Resources). 1985. 89p. NTIS, PC A05/MF A01.

The general public and influential citizens were surveyed concerning their opinions on various low-level radioactive-waste-disposal-siting policy issues. Specifically, they were asked to evaluate incentive options and power-sharing options relative to their desirability to an impacted community in terms of the degree of cooperation these options might elicit. Respondents were also asked who they trust to monitor the site, to regulate it, and to provide information on radioactive waste. In addition, they were asked about the preferred facility design.

25394 **(PNL-SA—13356) In-situ vitrification: a large-scale prototype for immobilizing radioactively contaminated waste.** Carter, J.G.; Buelt, J.L. (Pacific Northwest Labs., Richland, WA (USA)). Mar 1986. Contract AC06-76RL01830. 6p. (CONF-860317—28). NTIS, PC A02/MF A01; GPO Dep. File Number DE86007732.

From Waste management '86; Tucson, AZ, USA (2 Mar 1986).

Pacific Northwest Laboratory is developing the technology of in situ vitrification, a thermal treatment process for immobilizing radioactively contaminated soil. A permanent remedial action, the process incorporates radionuclides into a glass and crystalline form. The transportable process consists of an electrical power system to vitrify the soil, a hood to contain gaseous effluents, an off-gas treatment system and cooling system, and a process control station. Large-scale testing of the in situ vitrification process is currently underway.

25395 **(SAND—85-2505C) Developing a data acquisition system for the Waste Isolation Pilot Plant's in situ tests.** McIlmoyle, J.T.; Matalucci, R.V.; Ogden, H.C. (Sandia National Labs., Albuquerque, NM (USA)). 1986. Contract AC04-76DP00789. 30p. (CONF-860566—2). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86007705.

From Electronic components conference; Seattle, WA, USA (5 May 1986).

The US Department of Energy is developing the Waste Isolation Pilot Plant in southeastern New Mexico as an R and D facility to demonstrate the safe disposal of radioactive wastes from US defense programs. The in situ tests associated with this facility (659 m below the surface) address technical issues of thermal/structural interaction, waste package performance, and plugging and sealing. Data from these tests are collected by a Data Acquisition System (DAS) consisting of two distinct entities that use the IEEE-488 bus for communication. Up to 5000 data channels can be recorded every 4 hr from extensometers, stressmeters, thermocouples, closure gages, and other special gages. The DAS consists of a multitasking and multiuser ModComp computer housed in a surface trailer that converts the data to engineering units, stores the data in raw and converted form, and provides quick-look plots and data listings. The other part of the DAS consists of the seven underground remote enclosed instrument stations (sheds) located near each test room and up to 1800 m from the surface trailer that contains the instruments and signal conditioning to operate and monitor the tests. The ModComp system manages data acquisition and supports concurrently 12 on-line terminals and two dial-up access lines for data access, gage diagnostics, data handling and updating, and software development. Data are currently acquired from over 4000 gages with 15,000 defined measurands; the system can be expanded to 65,534 measurands. 4 refs., 7 figs.

25396 **(UCRL—94031) Control of research oriented software development.** Lewis, L.C.; Dronkers, J.J.; Pitsker, B. (Lawrence Livermore National Lab., CA (USA)). Dec 1985. Contract W-7405-ENG-48. 9p. (CONF-860563—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86006681.

From 40. annual quality congress; Anaheim, CA, USA (19 May 1986).

The Nuclear Waste Policy Act of 1982 directs the Department of Energy (DOE) to dispose permanently high level radioactive waste and civilian spent nuclear fuel by January 31, 1998. DOE has responded by creating an organizational structure that directs all the activities necessary to carry out the legislative demands. LLNL is conducting research in the earth sciences and is developing some unique computer codes to help establish the feasibility of geologic repositories for nuclear waste. LLNL has several codes under development. This paper examines the administrative and organizational measures that were and still are being undertak-

en in order to control the development of the two major codes. In the case of one code, the software quality assurance requirements were imposed five years after the code began its development. This required a retroactive application of requirements. The other code is still in the conceptual stages of development and here requirements can be applied as soon as the initial code design begins. Both codes are being developed by scientists, not computer programmers, and both are modeling codes, not data acquisition and reduction codes. Also the projects for which these codes are being developed have slightly different software quality assurance requirements. All these factors contribute unique difficulties in attempts to assure that the development not only results in a reliable prediction, but that whatever the reliability, it can be objectively shown to exist. The paper will examine a software management model. It will also discuss the reasons why it is felt that this particular model would stand a reasonable chance for success. The paper will then describe the way in which the model should be integrated into the existing management configuration and tradition.

25397 **(YJT—84-20) Determination of hydraulic conductivity in Lavia borehole, Finland.** Almen, K.E.; Persson, O. (Voimayhtioeiden Ydinjaetetoimikunta, Helsinki (Finland)). Sep 1984. 48p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86701440.

The investigations have been carried out as transient injection tests with constant pressure and subsequent pressure fall-off tests. The tests have been performed in accordance with the tests used in Sweden for site investigations. In total, 900 m of the 1001 m long borehole have been tested in 30 m long sections. The equipment used for the hydraulic tests was the umbilical hose system, developed within the Swedish KBS project. The umbilical hose equipment automatically operate each test during the entire test sequence. The different phases are: packer sealing (30 min), water injection (2 hours) and pressure fall-off (2 hours). In addition to the water-pressure and flowrate, the equipment is continuously measuring the barometric pressure, packer pressure, free groundwater level and different temperatures. Immediately after each test 13 different diagrams needed for the evaluation are plotted by a microcomputer, which also calculates a preliminary value of the hydraulic conductivity. The hydraulic conductivity of the bedrock in the vicinity of the borehole has primarily been determined by transient evaluation of the injection phase. Also the skin factor, effective borehole radius have been calculated. The evaluation of the water injection tests in the Lavia borehole give values of the hydraulic conductivity between 9.7×10^{-12} m/s and 2.7×10^{-7} m/s. From the highest value at test section 73-103 m, the hydraulic conductivity is decreasing to the measuring limit at c. 300 m. Then follows an interval with increasing hydraulic conductivity to a peak value of 3.2×10^{-8} m/s to again decrease to the measuring limit at c. 500 m. The interval from 493 m to 863 m is characterized by hydraulic conductivities near the measuring limit. At the lower part of the borehole the K-values again increase to a maximum value of 2.5×10^{-7} near the bottom of the borehole.

25398 **(YJT—85-14) Measurements of the state of stress in deep drill holes.** Vaeaetaeinen, A.; Saerkkae, P. (Voimayhtioeiden Ydinjaetetoimikunta, Helsinki (Finland)). May 1985. 81p. (In Finnish). NTIS (US Sales Only), PC A05/MF A01. File Number DE86701441.

The state of stress in rock is one of the most important parameters in the safe planning of stable underground openings in rock. At the same time, it is very difficult to be determined from a great distance. The common methods for the determination of state of stress in bedrock are usually not able to do this from a distance over 30 m. This work is a survey on rock stress determination methods usable in deep, over 500 m, drill holes. It also contains a recommendation for a method to determine the state of stress in Lavia test hole. The presented recommendation for the measurement of the state of stress contains an estimation on the working time for the measurement as well as the amount and location of the measuring points. The examination of the methods has been concentrated on three methods, hydraulic fracturing, overcoring by Vattenfall and differential strain analysis. Theoretical background of these methods has been analyzed. A special interest has been laid on the fundamental assumptions of different methods and their influence on the reliability of the results and the interpretation of the state of stress. The comparison of the methods has been made by literature and user interviews. Equipment and personnel needed, and way of measurement are described for the methods. The parameters measured and their possible sources of errors are described, too, as well as the fundamental assumptions and potential difficulties in the measurement. The organizations in Scandinavia performing measurements and their abilities to do measurements and interpretation are presented. Readiness to interpretation in Finland is described shortly.

25399 **(YJT—85-17) Interpretation of the results from hydraulic measurements carried out in Olkiluoto in 1980-1983.** Ylinen, A.; Pirhonen, V.; Saari, K. (Voimayhtioeiden Ydinjaetetoimikunta, Helsinki (Finland)). May 1985. 74p. (In Finnish). NTIS (US Sales Only), PC A04/MF A01. File Number DE86701442.

Hydraulic tests were done in the Olkiluoto power plant area during years 1980-1984. The aim of the tests was to study the suitability of the area disposal of reactor waste in rock caverns. The tests were mainly single hole pulse and slug tests with single and double packer configuration. A few hole-to-hole pulse tests and tracer tests were also made. The hydraulic properties of the joints were estimated based on the parallel plate model. In double packer tests the joints in the measuring interval were observed from photographs taken of the rock cores. When fractures in an interval were assumed similar average hydraulic conductivities of the fractures were calculated based on the cubic law. Variation of the hydraulic conductivity of the rock along the length of the borehole was obtained by comparing the plots made of conductivity values assuming the validity of Moye's law. Additional information of the hydraulic conductivity of rock was obtained from the time-pressure plots of slug tests. Assuming radial flow around the length of the borehole between the packers a value for hydraulic conductivity could be determined based on the exponential curve fitted to the measured data. Values of hydraulic conductivity and fracture aperture with laminar and turbulent flow assumptions were determined. Generally the hydraulic conductivity values were one order of magnitude higher using the laminar flow assumption. Pressure pulse propagation around a borehole was simulated using transient anisotropic finite element flow model with and without joint elements. In the tests the observation holes were at distances 50 to 100 metres from the pressurised hole. The comparison of measured and calculated pressure curves confirms the conclusions based on geological observations. The tonalite formation where the disposal caverns are planned to be built has considerably lower hydraulic conductivity than the surrounding gneissic rocks.

25400 **Source term characterization for the Maxey Flats low-level radioactive waste disposal site.** Dayal, R.; Pietrzak, R.F.; Clinton, J.H. (Brookhaven National Lab., Dept. of Nuclear Energy, Upton, NY 11973). *Nuclear Technology;* **72**: No. 2, vp(Feb 1986).

The results of source term characterization studies for the Maxey Flats low-level radioactive waste disposal site show that because of the long residence time of water accumulations in the trenches, prolonged leaching and microbial degradation of waste materials occur continuously, leading to leachate formation. As a result of such interactions for extended time periods, the resultant trench leachates exhibit significant modifications in terms of inorganic, organic, and radionuclide constituents and acquire geochemical properties that are unique, compared to ambient groundwater. The leachates generally exhibit varying degrees of anoxia characterized by negative redox potentials, low dissolved oxygen and sulfate concentrations, high alkalinity, and high ammonia concentrations. The enrichments, to varying degrees, of inorganic, organic, and radionuclide constituents associated with fuel cycle and nonfuel cycle low-level wastes reflect the nature of the leaching process itself and of the waste materials. Elevated concentrations of Na^+, K^+, Fe/sub TOTAL/, Mn/sub TOTAL/, Cl^-, dissolved organic and inorganic carbon, and several organic compounds as well as radionuclides, such as ^{3}H, ^{241}Am, ^{60}Co, ^{134}Cs, ^{137}Cs, ^{90}Sr, ^{238}Pu, and ^{239}/sup,^{240}Pu are a consequence of waste leaching. Some of the waste-derived organic compounds present in the trenches, such as chelating agents and several carboxylic acids, are strong complexing agents and have the potential to form stable radionuclide complexes and thus enhance nuclide mobility. The consequences of past disposal practices as reflected in the problems asso-

ciated with the burial of unsegregated, poorly packaged, and unstabilized wastes at the Maxey Flats disposal site indicate the significance of waste segregation, improved stabilization, and proper packaging.

25401 **Oxidation-induced geochemical changes in trench leachates from the Maxey Flats low-level radioactive waste disposal site.** Dayal, R.; Pietrzak, R.F.; Clinton, J.H. (Brookhaven National Lab., Dept. of Nuclear Energy, Upton, NY 11973). *Nuclear Technology;* 72: No. 2, vp(Feb 1986).

A knowledge of extra-trench processes related to oxidation-induced geochemical changes that are likely to occur when iron-rich, anoxic trench waters encounter an oxidizing environment along a redox gradient is essential for modeling radionuclide transport at low-level waste (LLW) disposal sites. The results of laboratory oxidation experiments on several trench leachates from the Maxey Flats site show that, upon oxidation, a series of geochemical changes were initiated that resulted in a drastically different solute geochemistry, involving oxidation of ferrous iron and subsequent precipitation of ferric oxyhydroxide, changes in alkalinity and acidity, a drastic increase in redox potential (Eh), and generally relatively little change in the concentrations of ^{60}Co, ^{137}Cs, and ^{85}Sr in solution. The observations made in this study have important geochemical implications for the modeling of LLW sites in that the source term as an input parameter cannot be assumed to be constant, both spatially and temporally. The acid-generating potential and buffering capacity of an anoxic source term are important geochemical controls that maintain a balance between acidity and alkalinity and largely determine the nature and extent of oxidation-induced geochemical changes likely to occur along a redox gradient. The presence of organic chelating agents can alter the source term geochemistry to such an extent that authigenic ferric oxyhydroxide, which represents a geochemical discontinuity at the redox interface along leachate migration paths, proves to be a relatively ineffective sink for radionuclides.

25402 **Spent fuel and radioactive waste: an Integrated Data Base of inventories, projections, and characteristics.** Notz, K.J.; Forsberg, C.W.; Mastal, E.F. (Oak Ridge National Laboratory, Oak Ridge, TN). pp 163-168 of Waste isolation in the US, technical programs and public education. Vol. 1. La Grange Park, IL; American Nuclear Society (1984). (CONF-840307—).

From Waste management '84; Tucson, AZ, USA (11 Mar 1984).

The Integrated Data Base (IDB) Program provides official U.S. Department of Energy (DOE) data on spent fuel and radioactive waste inventories, projections, and characteristics. This information is provided through the cooperative efforts of the IDB Program and DOE lead offices, lead sites, major programs, and generator sites. The program is entering its fifth year, and major accomplishments are summarized in three broad areas: the annual inventory report, including ORIGEN2 applications and a Quality Assurance (QA) plan; the summary data file and direct user access; and data processing methodology and support to other programs. Plans for future work in these areas are outlined briefly, including increased utilization of personal computers. Some examples of spent fuel data are given in terms of projected quantities for two growth scenarios, burnup and age profile of the existing inventory, and the approximate specific thermal power relative to high-level waste (HLW) from various sources.

25403 **Residual radionuclide contamination within and around nuclear power plants: origin, distribution, inventory and decommissioning assessment.** Robertson, D.E.; Abel, K.; Carrick, L.C.; Evans, J.C.; Leale, M.W.; Lepel, E.A.; Thomas, C.W.; Thomas, W.V. (Pacific Northwest Laboratory, Richland, Washington). *Radioactive Waste Management;* 5: No. 4, 285-310(1984).

The residual radionuclide concentrations, distributions and inventories at seven nuclear power plants have been investigated to provide a data base for use in formulating policies, strategies and guidelines for the eventual decommission of retired nuclear power plants. Emphasis has been placed on measuring the long-lived radionuclides which are of special concern from a low-level waste management standpoint, including ^{60}Co, ^{59}Ni, ^{63}Ni, ^{90}Sr, ^{94}Nb, ^{99}Tc, ^{129}I, ^{137}Cs, and alpha-emitting transuranic radionuclide with half-lives greater than five years. Initial results indicate that the most abundant long-lived radionuclides associated with contaminated piping, hardware and concrete for a period of up to about 10 to 20 years after shutdown generally include ^{60}Co, ^{55}Fe, ^{63}Ni and ^{137}Cs. Cobalt-60 and ^{137}Cs will be the main contributors to the external whole body dose for several decades following shutdown. Cobalt-58, ^{54}Mn and ^{65}Zn are abundant short-lived radionuclides at the time of shutdown. Contamination residues normally contained very low concentrations of ^{90}Sr, ^{94}Nb, Pu, Am and Cm. Iodine-129 and ^{99}Tc being very soluble long-lived radionuclides, were generally not associated with residual radionuclide contamination to any significant degree. A significant observation is that essentially all of the contaminated piping and hardware (excluding the pressure vessel internals) and concrete within nuclear power plants can be disposed of as Class A waste, the least restrictive waste category specified in 10 CFR 61, "Licensing Requirements for Land Disposal of Radioactive Wastes."

25404 **The Defense Waste Processing Facility capital cost estimate.** Cowan, S.P.; Geiger, J.W. (US Department of Energy, Washington, DC). pp 359-364 of Waste isolation in the US, technical programs and public education. Vol. 1. La Grange Park, IL; American Nuclear Society (1984). (CONF-840307—).

From Waste management '84; Tucson, AZ, USA (11 Mar 1984).

The Defense Waste Processing Facility (DWPF) will be the Nation's first production-scale facility to immobilize high-level nuclear waste for disposal. The DWPF will be built at the Department of Energy's Savannah River Plant near Aiken, South Carolina. Approximately 30 million gallons of high-level waste, stored as liquid, salt cake, and sludges in underground tanks, have accumulated from almost 30 years of operation of the Savannah River Plant. The DWPF will immobilize this waste in borosilicate glass for eventual disposal in a Federal repository. The DWPF project includes (1) remotely operated facilities to immobilize the high-activity fraction of the waste in borosilicate glass in stainless steel canisters; (2) facilities to solidify the low-level fraction (decontaminated liquid and salt) for disposal on the Savannah River Plant site; and (3) support facilities for safe and efficient plant operation. Construction began in 1983, and the facilities will be completed and operational in 1989. The total estimated cost to design and construct all of the facilities included in the DWPF project is $870 million. The focus of this paper is on the DWPF cost estimate. The paper briefly describes the facilities included in the DWPF project and describes the assumptions and methodology used to prepare the detailed cost estimate for design and construction. The cost estimating and risk analysis models used to verify the detailed estimate are also discussed. The paper also describes the design improvements and innovations which have resulted in cost reductions for the DWPF project from the $2.8 billion estimated in 1978 to the present estimate of $870 million. Finally, the paper describes the cost control method that are being used to insure that the DWPF will be completed within the estimated cost.

25405 **Dealing with uncertainties in the development of a geologic repository for high-level waste.** White, L.A.; Bermanis, H.L.; Frei, M.W.; Wiot, E.R. (Roy F. Weston, Inc., Rockville, MD). pp 127-130 of Waste isolation in the US, technical programs and public education. Vol. 1. La Grange Park, IL; American Nuclear Socoety (1984). (CONF-840307—).

From Waste management '84; Tucson, AZ, USA (11 Mar 1984).

A geologic repository combines a number of technologies in a unique way, must function over geologic time, and by its nature requires a level of understanding of subsurface conditions that is unprecedented. The uncertainties that derive from this are significant in terms of demonstration of repository performance in licensing. The Department of Energy is approaching the problem by identifying the major areas of uncertainty and reducing those uncertainties through an iterative process of investigation and testing; anticipating irreducible residual uncertainties likely to remain due to practical limitations, and developing and evaluating practical so-

lutions for dealing with those irreducibles. A comprehensive site characterization program leading to prudent site selection coupled with a defense-in-depth approach to design is the major focus of the DOE effort to deal with those uncertainties.

25406 **TMT abnormal wastes disposal options.** Ayers, A.L. Jr. (EG & G Idaho, Inc., Idaho National Engineering Laboratory, Idaho Falls, ID). pp 585-590 of Waste isolation in the US, technical programs and public education. Vol. 1. La Grange Park, IL; American Nuclear Society (1984). (CONF-840307—).

From Waste management '84; Tucson, AZ, USA (11 Mar 1984).

A substantial quantity of high beta-gamma/high-TRU contaminated wastes are expected from cleanup activities of Unit 2 of the Three Mile Island Nuclear Power Station. Those wastes are not disposable because of present regulatory constraints. Therefore, they must be stored temporarily. This paper discusse three options for storage of those wastes at the Idaho National Engineering Laboratory: (a) storage in temporary storage casks, (b) underground storage in vaults, and (c) storage in silos at a hot shop. Each option is analyzed and evaluated. Also included is a discussion of future disposal strategies, which might be pursued when a suitable federal or commercial repository is built.

25407 **Radioactive waste management as approached by Nuclear Materials Management.** Reyes, B.D. (EG & G Idaho, Inc.). pp 643-646 of Waste isolation in the US, technical programs and public education. Vol. 1. La Grange Park, IL; American Nuclear Society (1984). (CONF-840307—).

From Waste management '84; Tucson, AZ, USA (11 Mar 1984).

Nuclear Materials Management at EG & G Idaho, Inc., works energetically to maximize recovery of excessed nuclear fuel. This paper summarizes four fuel dispositions of nonroutine or odd lot fuels and supports the concept that recovery is the optimal disposal method. Specific packaging, recordkeeping, and timely disposal problems are described. The need for cooperative planning among nuclear materials and waste management personnel, contract personnel, and the program experimenters who use the fuel is stressed.

25408 **Construction features of the Exploratory Shaft at Yucca Mountain.** Adair, G.W.; Fiore, J.N. (Reynolds Electrical & Engineering Co., Inc.). pp 241-247 of Waste isolation in the US, technical programs and public education. Vol. 1. La Grange Park, IL; American Nuclear Society (1984). (CONF-840307—).

From Waste management '84; Tucson, AZ, USA (11 Mar 1984).

The Exploratory Shaft (ES) at Yucca Mountain is planned to be constructed during 1985 and 1986 as part of the detailed site characterization for one of three sites which may be selected as candidates for location of a high-level radioactive waste repository. Conventional mining methods will be used for the shaft sinking phase of the ES project. The ES will be comprised of surface support facilities, a 1,480-foot-deep circular shaft lined with concrete to a finished inside diameter of 12 feet, lateral excavations and test installations extending up to 200 feet from the shaft, and long lateral borings extending up to 2,300 feet from the shaft. The estimated time for sinking the shaft to a total depth of about 1,480 feet and completing the lateral excavations and borings is about two years. The major underground development planned for the primary test level at a depth of 1,200 feet consists of the equivalent of 1,150 feet of 15- by 15-foot drift. The total volume of rock to be removed from the shaft proper and the lateral excavations totals about 1/2 million cubic feet. Construction equipment for the shaft and underground excavation phases consists of conventional mine hoisting equipment, shot hole and rock bolt drilling jumbos, mucking machines, and hauling machines. The desire to maintain relatively uniform and even walls in selected shaft and drift intervals will require that controlled blasting techniques be employed. Such techniques generally classified as "smooth blasting" are commonly used for excavation in the construction industry.

25409 **Preliminary worst-case accident analysis to support the conceptual design of a potential repository in tuff.** Jackson, J.L.; Gram, H.F.; Hong, K.J.; Ng, H.S.; Pendergrass, A.M. (Nuclear Waste Engineering Projects Division, Sandia National Laboratories, Albuquerque, NM). pp 561-568 of Waste isolation in the US, technical programs and public education. Vol. 1. La Grange Park, IL; American Nuclear Society (1984). (CONF-840307—).

From Waste management '84; Tucson, AZ, USA (11 Mar 1984).

The Nevada Waste Storage Investigations (NNWSI) Project is conducting investigations to determine suitability of a site at Yucca Mountain for development as a high-level waste repository. In support of conceptual design, a preliminary analysis has been performed to identify events that could cause radiological releases from the surface facilities during the operations period. Accidental releases were modeled short-duration release plumes, dispersed under averaged climatic conditions, using the AIRDOS-EPA code. consequences of these accidents, in 50-yr integrated dose commitments to operations personnel, to the minimally exposed member of the public, and to the general population in the surrounding area were calculated. risk to the general public from each event was also assessed. All postulated accidents result in doses to pers of the public that are lower than the 0.5 rem/accident limit set by the NRC in 10 CFR 60. For those accidents that do not involve both fire and breach of waste canisters, doses to operations personnel are behind the NRC limit for routine operations of 5 rem/yr set in 10 CFR 20. Accidents that involve fire and breach of waste canisters may cause doses to some operations personnel that are in excess of this limit.

25410 **Costs for disposal of Savannah River high-level waste in a commercial repository.** McDonell, W.R. (EI du Pont de Nemours & Co., Savannah River Laboratory, Aiken, SC). pp 553-560 of Waste isolation in the US, technical programs und public education. Vol. 1. La Grange Park, IL; American Nuclear Society (1984). (CONF-840307—).

From Waste management '84; Tucson, AZ, USA (11 Mar 1984).

Costs for SRP high-level waste disposal were projected using baseline conceptual designs for commercial nuclear waste repositories to accommodate defense waste packages in an "augmented repository" mode for 10,000 SRP waste canisters emplaced in conjunction with spent fuel and commercial processed waste in salt, tuff, and basalt repositories, the defense high-level wastes (DHLW) would occupy an underground repository area 5-7% of that committed to commercial high-level wastes. Direct costs representing incremental expenditures for DHLW disposal in the commercial waste repositories depended on repository geology, waste packaging requirements, and underground emplacement patterns. For a representative repository utilizing steel overpacks on emplaced canisters, direct costs of SRP waste disposal would be about $580 million, with a major fraction ($51,500/canister) directly proportional to the number of canisters emplaced. Indirect costs representing allocated charges for DHLW use of repository facilities in common with commercial wastes were estimated for the basalt repository at about $245 million, bringing total repository costs for SRP waste disposal to about $825. Elimination of overpack requirements would reduce the SRP repository costs by about $220 million.

25411 **The effect of waste age on the design of a geologic repository.** O'Brien, P.D.; Shirley, C.G. (Sandia National Laboratories, Albuquerque, NM). pp 527-530 of Waste isolation in the US, technical programs and public education. Vol. 1. La Grange Park, IL; American Nuclear Society (1984). (CONF-840307—).

From Waste management '84; Tucson, AZ, USA (11 Mar 1984).

Spent fuel from civilian power reactors has been accumulating since 1969, and will be as old as 29 years out-of-reactor in 1998, when the first US repository for commercial radioactive waste is scheduled to begin operation. In an oldest-waste-first scenario, the first heat-producing waste committed to a repository will be 29 years old at the time of emplacement. Age at emplacement will decrease as the inventory of old waste is depleted, and will vary throughout the operating life of the repository. The age of the

waste influences the deposition of decay energy in the waste packages themselves and in the geologic medium in which the waste packages are emplaced for disposal. In the short term, there is a local temperature pulse that is the principal consideration in the design of waste canisters-which, of course, are tailored to the individual waste forms to be emplaced. In the longer term, and on a more regional scale, the thermomechanical response of the host rock to areal energy deposition determines the design of the disposal arrays within the repository. This report is concerned with the latter problem. It is shown that the effect of waste age variability on the thermomechanical stability of the host geology can be minimized by the proper choice of waste canister spacings.

25412 **Characterization of crystalline rocks in the Lake Superior region, USA: implications for nuclear waste isolation.** Sood, M.K.; Edgar, D.E.; Flower, M.F.J. (Geoscience and Engineering Group, Energy and Environmental Systems Division, Argonne National Laboratory, Argonne, IL). pp 513-526 of Waste isolation in the US, technical programs and public education. Vol. 1. La Grange Park, IL; American Nuclear Society (1984). (CONF-840307—).

From Waste management '84; Tucson, AZ, USA (11 Mar 1984).

The Lake Superior region (Wisconsin, the Upper Peninsula of Michigan, and Minnesota) contains 41 Precambrian crystalline (medium- to coarse-grained igneous and high-grade metamorphic) rock complexes comprising 64 individual but related rock bodies with known surface exposures. Each complex has a map area greater than 78 km^2. About 54% of the rock complexes have areas of up to 500 km^2, 15% fall between 500 km^2 and 1000 km^2, 19% lie between 1000 km^2 and 2500 km^2, and 12% are over 2500 km^2. Crystalline rocks of the region vary widely in composition, but they are predominantly granitic. Repeated thermo-tectonic events have produced early Archean gneisses, migmatites, and amphibolites with highly tectonized fabrics that impart a heterogeneous and anisotropic character to the rocks. Late Archean rocks are usually but not invariably gneissose an migmatitic. Proterozoic rocks of the region include synorogenic (foliated) granitic rocks, anorogenic (nonfoliated) granites, and the layered gabbro-anorthosite-troctolite intrusives of the rift-related Keweenawan igneous activity. Compared with the Archean rocks of the region, the Proterozoic bodies generally lack highly tectonized fabrics and have more definable contacts where visible. Anorogenic intrusions are relatively homogeneous and isotropic. On the basis of observed geologic characteristics, postorogenic and anorogenic crystalline rock bodies located away from recognized tectonic systems have attributes that make them relatively more desirable as a possible site for a nuclear waste repository in the region. This study was conducted at Argonne National Laboratory under the sponsorship of the US Department of Energy through the Office of Crystalline Repository Development at Battelle Memorial Institute, Columbus, Ohio.

25413 **WIPP Construction methods and progress.** Likar, V.F.; Cooper, W.R. (Westinghouse Electric Corp., WIPP Technical Support Contractor, Albuquerque, NM). pp 257-260 of Waste isolation in the U.S., technical programs and public education. Vol. 1. La Grange Park, IL; American Nuclear Society (1984). (CONF-840307—).

From Waste management '84; Tucson, AZ, USA (11 Mar 1984).

The Department of Energy is constructing the Waste Isolation Pilot Plant (WIPP) in southeast New Mexico. The facility will retrievably store transuranic waste from defense activities of the United States and conduct experiments with Defense High Level Waste which will be retrieved at the end of the experiments. This paper describes the progress and the present status of construction on WIPP.

25414 **Construction of a nuclear waste repository in Basalt at Hanford, Washington.** Larvie, F.C. (Morrison-Knudsen Company, Inc., Basalt Waste Isolation Project, Hanford Reservation, Richland, WA). pp 247-250 of Waste isolation in the U.S., technical programs and public education. Vol. 1. La Grange Park, IL; American Nuclear Society (1984). (CONF-840307—).

From Waste management '84; Tucson, AZ, USA (11 Mar 1984).

25415 **The DOE demonstration program for at-reactor dry storage: a utility perspective.** Martin, L.H. (Carolina Power & Light Company, Raleigh, NC). pp 177-178 of Waste isolation in the U.S., technical programs and public education. Vol. 1. La Grange Park, IL; American Nuclear Society (1984). (CONF-840307—).

From Waste management '84; Tucson, AZ, USA (11 Mar 1984).

25416 **Two years on the front line: lessons learned in an information office.** Pendelton, M. (Moab, Utah, Nuclear Waste Information Office, Battelle's Office of Nuclear Waste Isolation, Columbus, OH). pp 211-214 of Waste isolation in the U.S., technical programs and public education. Vol. 1. La Grange Park, IL; American Nuclear Society (1984). (CONF-840307—).

From Waste management '84; Tucson, AZ, USA (11 Mar 1984).

Michaelene Pendleton has been operating an information office for the nuclear waste isolation program for almost two years. Her experience has taught her the importance of maintaining credibility in the public eye, while providing accurate information on a highly technical subject. She offers suggestions on how technical staff can maintain that credibility before the general public.

25417 **Estimating and coping with public response to radioactive waste repository siting.** Payne, B.A. (Environmental Research Division, Argonne National Laboratory, Argonne, IL). pp 205-210 of Waste isolation in the U.S., technical programs and public education. Vol. 1. La Grange Park, IL; American Nuclear Society (1984). (CONF-840307—).

From Waste management '84; Tucson, AZ, USA (11 Mar 1984).

The siting, construction, and operation of a radioactive waste repository is likely to be controversial in the communities being considered and at the state and national levels as well. Public response can be conceptualized at two levels: individual and group or organizational. At the individual level, public response is the behavior of people motivated by their attitudes, knowledge, and perceptions of radioactive waste and its hazards and risks. Groups or organizations provide a structure to public response through which to pool resources and talents, set up a division of labor, hire experts, develop a skilled leadership, take legal action, and so on. A broad range of organizations is possible: ad hoc, existing community groups with an added purpose, nationally-recognized organizations, or government offices and agencies. Two cases of response to radioactive waste disposal sites illustrate these sources and kinds of response and suggest indicators to estimate the nature and level of response. Specific coping strategies take different forms, depending on the nature and level of response (either supporting or opposing) to the proposed siting, the past experience of community members with similar projects, with federal agencies, and with citizens' action groups, and sources and accuracy of information individuals and groups have. All strategies are based on a policy of honesty and straight-forwardness, with a sincere effort on the part of site evaluators and decision-makers to be attentive and responsive to the public's concerns.

25418 **Actinide solubility controls in performance assessment of nuclear waste repositories.** Rai, Dh.; Strickert, G.; Swanson, J.L. (Pacific Northwest Laboratory, Richland, WA). pp 335-341 of Waste management '83. Vol. 2. La Grange Park, IL; American Nuclear Society (1983). (CONF-830205—).

From Waste management conference; Tucson, AZ, USA (27 Feb 1983).

The importance of solubility control of radionuclide concentrations in repository groundwaters is discussed. Such control allows readily defensible estimation of the maximum concentrations of some actinide radionuclides in groundwaters. Estimates from currently available data indicate a number of cases where such maximum concentrations will be near or below the concentrations that are permissable, without the benefit of other processes that will lower the concentrations even more. Available information is brief-

ly summarized and further research needs, which are not overly extensive, are discussed.

25419 **Quality assurance for geologic investigations.** Delvin, W.L.; Gustafson, L.D. (Westinghouse Hanford Company, Richland, WA). pp 359-366 of Waste management '83. Vol. 2. La Grange Park, IL; American Nuclear Society (1983). (CONF-830205—).

From Waste management conference; Tucson, AZ, USA (27 Feb 1983).

A quality assurance handbook was written to provide guidance in the application of quality assurance to geologic work activities associated with the National Waste Terminal Storage (NWTS) Program. It is intended to help geoscientists and NWTS program managers in applying quality assurance to their work activitie and projects by showing how technical and quality assurance practices are integrated to provide control within those activities and projects. The use of the guidance found in this handbook should help provide consistency in the interpretation of quality assurance requirements across the various geologic activities within the NWTS Program. This handbook also can assist quality assurance personnel in understanding the relationships between technical and quality assurance practices. This paper describes the handbook.

25420 **Conclusions regarding geotechnical acceptability of the WIPP site.** Weart, W.D. (Waste Management Technology Department, Sandia National Laboratories, Albuquerque, NM). pp 373-376 of Waste management '83. Vol. 2. La Grange Park, IL; American Nuclear Society (1983). (CONF-830205—).

From Waste management conference; Tucson, AZ, USA (27 Feb 1983).

Site evaluation studies for the Waste Isolation Pilot Plant are essentially complete. These studies have made extensive use of existing data, geologic mapping, exploration geophysics, and boreholes. Those issues that have been most contentious and that have now been thoroughly investigated are those of salt dissolution, deformation of the Castile salt beds and associated phenomena (i.e., brine reservoirs), definition of the hydrologic regime, and the potential conflict with natural resources. The first two phenomena have been shown not to present a significant threat to WIPP during its required lifetime. The hydrologic regime has been adequately characterized, and it is very favorable with respect to its role in possible breach scenarios. There is a potential for natural resources at the WIPP site, but all promising resources can be exploited without jeopardy to the WIPP. Future breaches by human activity cannot be ruled out but consequences of such activities are relatively benign.

25421 **Testing and significance of pressurized fluid reservoir encounters for the site characterization process for radioactive waste disposal facilities.** Register, J.K.; Little, Ch.C. (Institutional and Environmental Assessments, WIPP Project, D'Appolonia Consulting Engineers, Inc.). pp 377-386 of Waste management '83. Vol. 2. La Grange Park, IL; American Nuclear Society (1983). (CONF-830205—).

From Waste management conference; Tucson, AZ, USA (27 Feb 1983).

The Waste Isolation Pilot Plant (WIPP) project is a U.S. Department of Energy (DOE) research and development activity to demonstrate safe disposal of transuranic (TRU) waste from the nation's defense programs. During the past seven years, an extensive site characterization effort has been conducted in the Los Medanos area of southeastern New Mexico. A portion of the effort addressed the mode of occurrence and origin of flowing artesian brine reservoirs known to exist in the northern Delaware Basin (the WIPP site area). Investigation of these features was performed by comprehensive geological, hydrological and geochemical testing in two DOE boreholes that intersected reservoirs. The testing program plan was found to be a technically sound and cost effective method by which to develop and support hypotheses relative to the characteristics, genesis and history of the reservoirs. Similar testing programs would be applicable to the characterization of similar features at other potential waste disposal sites in bedded salt. The interpretation of the test results indicates that the brine reservoirs in the northern Delaware Basin should have no effect on the integrity of the WIPP facility.

25422 **Performance allocation traceable to regulatory criteria as applied to site characterization work at the Basalt Waste Isolation Project.** Deju, R.A.; Babad, H.; Bensky, M.S.; Jacobs, G.K. (Basalt Waste Isolation Project, Rockwell Hanford Operations, Richland, WA). pp 135-142 of Waste management '83. Vol. 2. La Grange Park, IL; American Nuclear Society (1983). (CONF-830205—).

From Waste management conference; Tucson, AZ, USA (27 Feb 1983).

The Basalt Waste Isolation Project has developed a method for defining in detail the work required to demonstrate the feasibility of emplacing and providing for the safe isolation of nuclear wastes in a repository in the deep basalts at the Hanford Site near Richland, Washington. Criteria analysis allows the identification of areas of significant technical uncertainty or controversy that can be highlighted as issues. A preliminary analysis has been conducted, which, by identifying key radionuclides and allocating performance among the multiple barriers in a repository constructed in a basalt, allows the design and development testing activities at the Basalt Waste Isolation Project to be put into perspective. Application of sophisticated uncertainty analysis techniques will allow refinements in the analysis to be made and to further guide characterization and testing activities. Preliminary results suggest that a repository constructed in basalt will provide for the safe isolation of nuclear wastes in a cost-effective and reliable manner with a high degree of confidence.

25423 **Byproduct inventories.** Wheelwright, E.J. (Pacific Northwest Laboratory, Richland, WA). pp 123-128 of Waste management '83. Vol. 2. La Grange Park, IL; American Nuclear Society (1983). (CONF-830205—).

From Waste management conference; Tucson, AZ, USA (27 Feb 1983).

An inventory of potentially available nuclear byproducts from defense production activities and from the commercial fuel cycle has been prepared for inclusion in the DOE document, Department of Energ Plan for Recovery and Utilization of Nuclear Byproducts from Defense Wastes, which should be issued in 1983 The byproduct materials included in the inventory are strontium-90, cesium-137, krypton-85, xenon, palladium, rhodium, ruthenium, technetium-99, americium-241, promethium-147, neptunium-237, and curium. The inventory summarizes the amounts of these materials in current wastes and projects the quantities contained in future wastes.

25424 **Cesium and strontium fractionation from high-level waste to reduce thermal stress in a geologic repository.** McKee, R.W. (Pacific Northwest Laboratory, Richland, WA). pp 105-112 of Waste management '83. Vol. 2. La Grange Park, IL; American Nuclear Society (1983). (CONF-830205—).

From Waste management conference; Tucson, AZ, USA (27 Feb 1983).

Results are described for a study that assessed the benefits and costs of fractionating the cesium and strontium components in commercial high-level waste (HLW) to a separate waste stream for the purpose of reducing geologic repository thermal stresses in the region of the HLW. System costs are developed for a broad range of conditions comparing the Cs/Sr fractionation concept with disposal of 10-year-old vitrified HLW and vitrified HLW aged to achieve (through decay) the same heat output as the fractionated high-level waste (FHLW). All comparisons are based on a 50,000 metric ton equivalent (MTE) system. The FHLW and the Cs/Sr waste are both disposed of as vitrified waste but emplaced in separate areas of a basalt repository. The FHLW is emplaced in high integrity packages at relatively high waste loading but low heat loading, while the Cs/Sr waste is emplaced in minimum integrity packages at relatively high heat loading in a separate region of the repository. System cost comparisons are based on minimum cost combinations of canister diameter, waste concentration, and canister spacing in a basalt repository. The effects on both long- and near-term safety considerations are also addressed. The major conclusion is that the Cs/Sr fractionation concept offers the prospect of a substantial total system cost advantage for HLW disposal if reduced HLW package temperatures in a basalt repository are desired. However, there is no cost advantage if currently designated maxi-

mum design temperatures are acceptable. Aging the HLW for 50 to 100 years can accomplish similar results at equivalent or lower costs.

25425 **Design of a waste package for emplacement in Basalt.** Anderson, W.J. (Rockwell Hanford Operations, Richland, WA). pp 11-16 of Waste management '83. Vol. 2. La Grange Park, IL; American Nuclear Society (1983). (CONF-830205—).

From Waste management conference; Tucson, AZ, USA (27 Feb 1983).

The Basalt Waste Isolation Project's (BWIP) Waste Package Program has been developed as part of th U.S. Department of Energy's National Waste Terminal Storage Program to provide a focal point for the selection of materials and development of designs for site-specific, multiple barrier assemblages for spent fuel and processed high-level waste disposal in basalt. This paper will report the results of a joint effort among th BWIP, Westinghouse-Advanced Energy Systems Division, Office of Nuclear Waste Isolation, and Kaiser Engineers Inc./Parsons Brinckerhoff Quade & Douglas, Inc. to develop conceptual designs for waste packages to be emplaced in a repository located in basalt. During Fiscal Year 1982, practical designs for commercial and defense high-level waste and circular bundles of spent fuel rods from three pressurized water reactor assemblies or seven boiling water reactor assemblies were developed on the basis of cost effectiveness. Each of the designs is based upon environmental and regulatory performance factors that were used in the developing package design criteria. The reference conceptual design, based on site-specific environmental conditions, consists of a waste form contained by a low carbon steel canister which is then surrounded by a backfill mixture of bentonite clay and crushed basalt. The conceptual waste packages have been utilized by the BWIP in updating the conceptual designs fo a nuclear waste repository in basalt and, thus, have been fully integrated into the remainder of the engineered repository structure.

25426 **A multiple waste receipt and packaging facility for a salt repository.** Carr, J.A.; Henderson, N.C.; Wrenshall, B. (Battelle Project Management Division, Columbus, OH). pp 33-36 of Waste management '83. Vol. 2. La Grange Park, IL; American Nuclear Society (1983). (CONF-830205—).

From Waste management conference; Tucson, AZ, USA (27 Feb 1983).

Present programmatic planning by the Department of Energy's National Waste Terminal Storage Program is directed toward the receipt and emplacement of a variety of waste types and forms in a mined geological repository. The repository would accept spent fuel (SF), reprocessed commercial high-level waste (CHLW) including West Valley waste (WVW), contact- and remote-handled commercial transuranic (TRU) waste, and defense high-level waste (DHLW). This paper presents the results of a conceptual design study for a multiwaste receiving and packaging facility located at a salt repository site.

25427 **Equipment for the emplacement of heat-producing waste in long horizontal boreholes.** Young, K.D.; Fisk, A.; Friant, J.; Scully, L.W. (Nuclear Waste Engineering Projects, Sandia National Laboratories, Albuquerque, NM). pp 37-43 of Waste management '83. Vol. 2. La Grange Park, IL; American Nuclear Society (1983). (CONF-830205—).

From Waste management conference; Tucson, AZ, USA (27 Feb 1983).

Emplacement of heat-producing waste in long horizontal holes may offer several technical and economic advantages over shallow vertical hole emplacement. Less of the host rock suffers damage as a resul of drift construction; the heat from the waste can be isolated from the access drifts for long periods of time; and the amount of rock which must be excavated is much less than in traditional disposal scenarios. One of the major reasons that has been used to reject the long hole concept in the past and adhere to the shallow vertical hole concept is the equipment required to drill the holes and to emplace and retrieve the waste. Such equipment does not currently exist. It clearly is more difficult to drill a 600 to 100 foot horizontal hole, possibly 3 to 4 feet in diameter, and place a canister of waste at the end of it than to drill a 30 foot vertical hole and lower the waste to the bottom. A liner, for emplacement hole stabilization, appears to be feasible by adapting existing technology for concrete slip forming or jacking in a steel liner. The conceptual design of the equipment to drill long horizontal holes, emplace waste and retrieve waste is discussed. Various options in concept are presented as well as their advantages and disadvantages. The operating scenario of the selected concept is described as well as solutions to potential problems encountered.

25428 **Effects of wire rope in mitigating a waste shaft accident.** Ellet, D.M. (Sandia National Laboratories, Albuquerque, NM). pp 43-48 of Waste management '83. Vol. 2. La Grange Park, IL; American Nuclear Society (1983). (CONF-830205—).

From Waste management conference; Tucson, AZ, USA (27 Feb 1983).

This report describes the empirical test program conducted on a 1/22-scale model of the WIPP facility. The model was designed to study the actions and effects of the wire rope used in the Koepe or friction-type hoist during various accident scenarios. It is assumed that the hoist cable breaks and the cab (or shaft conveyance) falls to the bottom of the shaft during such an accident. The report gives the results of the study and makes recommendations for a continuing program of testing and redesign of the shaft to mitigate the effects of such an accident. The wire rope is shown to act as a good shock-absorbing material.

0530 Environmental Aspects

REFER ALSO TO CITATION(S) 25409, 25418, 26277

25429 **(DOE/EIS—0063) Final Environmental Impact Statement: supplement to ERDA-1538, December 1975. Double-shell tanks for defense high-level radioactive waste storage.** (USDOE, Washington, DC). Apr 1980. 208p. NTIS, PC A10/MF A01; 1; GPO Dep. File Number DE86008214.

Proposed is the completion of construction and the operation of thirteen tanks for high-level radioactive liquid waste storage on an interim basis until long-term of final disposal of the wastes can be achieved. The scope of the EIS includes the examination of design alternatives for the tanks now under construction. The examination of the alternatives addressed in this EIS is in compliance with the September 29, 1979 directive of the US District Court for the District of Columbia [Natural Resources Defense Council, Inc., et al., v. Secretary, Department of Energy, et al. (DDC Civ. No. 76-169)]. The new facilities, now under construction, consist of thirteen 1.0 million gallon high-activity waste tanks and their auxiliaries. All thirteen tanks are being built in the 200 East Area of the Hanford Site. Impacts of the various design alternatives considered in this EIS are assessed on the basis of the effects of the various designs on tank durability, on the ease of waste retrieval from such tanks, on the choices (and on the timing of such choices) for a technology for long-term radioactive waste storage and final disposal, as well as on the environment in general. 75 refs., 38 figs., 13 tabs.

25430 **(NUREG/CR—4286) Evaluation of radioactive liquid effluent releases from the Rancho Seco Nuclear Power Plant.** Miller, C.W.; Cottrell, W.D.; Loar, J.M.; Witherspoon, J.P. (Oak Ridge National Lab., TN (USA)). 23 Dec 1985. Contract AC05-84OR21400. 105p. (ORNL—6183). NTIS, PC A06/MF A01 - GPO. File Number TI86005186.

A project has been carried out by Oak Ridge National Laboratory (ORNL) to estimate the concentrations of radionuclides in the environment that have resulted from the release of radioactive materials in the liquid waste effluents from the Rancho Seco Nuclear Power Plant (RSNPP) and to estimate possible radiation doses to man resulting from current environmental concentrations. To carry out the objectives of this project, two visits were made to the RSNPP site by scientists from ORNL during November and December of 1984 to conduct an environmental sampling program around the site. Elevated levels of some radionuclides were found in the immediate environment of the plant. This radioactive contamination occurs primarily along streams receiving effluent from the plant and in fields irrigated with water from these streams. The primary contaminants are ^{137}Cs and ^{134}Cs with lesser amounts of

^{60}Co and ^{55}Co. Specific pathways of exposure and usage factors were not precisely known for the dose assessment of current and potential use of contaminated water and soil around the RSNPP. The ingestion of fish is the single most important pathway identified in this analysis.

25431 **(NUREG/CR—4504) Long-term surveillance and monitoring of decommissioned uranium processing sites and tailings piles.** Young, J.A.; Cadwell, L.L.; Freeman, H.D.; Hawley, K.A. (Pacific Northwest Labs., Richland, WA (USA)). Mar 1986. Contract AC06-76RL01830. 47p. (PNL—5755). NTIS, PC A03/MF A01 - GPO. File Number TI86008555.

Natural processes and human activities could expose the public to radioactive and nonradioactive toxic materials from uranium processing sites in the years following decommissioning. This report describes security, surveillance, and monitoring methods that can be used to prevent or detect the spread of these materials and to determine when cleanup or preventive maintenance is required. Visual observations carried out at least annually can be used to detect any rapidly developing conditions that could expose the public to toxic materials. If no such conditions develop during the first several years following decommissioning, then visual observations can be made at less frequent intervals to detect more gradual changes. Gamma-radiation, ^{226}Ra, and ^{238}U measurements at locations showing significant deterioration can be used to determine whether residual radioactive materials that exceed existing standards have been exposed. Measurements of contaminant concentrations in standing surface water and groundwater can detect the spread of water containing elevated contaminant concentrations. Durable signs and stone markers can be used to warn of the possible dangers associated with these sites. 27 refs., 1 fig., 2 tabs.

25432 **Spent fuel cladding containment credit tests.** Wilson, C.N.; Oversby, V.M. (Westinghouse Hanford Company). pp 569-572 of Waste isolation in the US, technical programs and public education. Vol. 1. La Grange Park, IL; American Nuclear Society (1984). (CONF-840307—).

From Waste management '84; Tucson, AZ, USA (11 Mar 1984).

Preliminary tests are being conducted to evaluate the effectiveness of defected cladding as a barrier to radionuclide release from spent fuel rods stored in a geologic repository. These tests are in support of the Nevada Nuclear Waste Storage Investigations (NNWSI) tuff repository project. Leach tests are performed in a matrix that includes spent pressurized water reactor (PWR) fuel rod specimens with artificially induced cladding defects, specimens with intact cladding, and bare fuel with the cladding removed. The artificially induced cladding defects are made by laser drilling or sawing to give defect areas in the 10_4 /sigma phi/m_2 to 10_8 /sigma phi/m_2 range. Periodic samples of the leach solution and fused quartz rods contained in the test vessels are analyzed. Results for the first 180 days of testing are presented.

25433 **Radionuclide releases from a hypothetical nuclear waste repository: potential violations of the proposed EPA standard by radionuclides with multiple aqueous species.** Siegel, M.D.; Erickson, K.L. (Sandia National Laboratories, Albuquerque, NM). pp 541-546 of Waste isolation in the US, technical programs and public education. Vol. 1. La Grange Park, IL; American Nuclear Society (1984). (CONF-840307—).

From Waste management '84; Tucson, AZ, USA (11 Mar 1984).

The purpose of this work is to develop a methodology to identify physicochemical conditions where chemical speciation of radioelements must be considered in nuclear waste repository risk assessments. Previous studies of the compliance of hypothetical high-level waste repositories with the proposed EPA standard (40 CFR Part 191) have used radionuclide retardation factors that describe the average effect of all chemical interactions of the radionuclide within the fluid and with the rock matrix. The above approach may underestimate radionuclide discharges and disguise potential violations of the EPA standard. In the method described in this paper, an approximate transport model is obtained that bounds the rate of chemical speciation reactions such that maximum radionuclide discharges are easily calculated. The analysis is applied to the discharge of neptunium-237 from a reference repository. A sensitivity analysis is performed that determines critical combinations of hydrologic and chemical parameters that result in discharges violating the EPA standard.

0540 Health And Safety

REFER ALSO TO CITATION(S) 26276, 26277, 26315

25434 **(BNL—36786-Pt.1) Radiological assistance program: Region I. Part I.** Musolino, S.V.; Kuehner, A.V.; Hull, A.P. (Brookhaven National Lab., Upton, NY (USA)). 15 Jul 1985. Contract AC02-76CH00016. 20p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86008009.

The purpose of the Radiological Assistance Program (RAP) is to make DOE resources available and provide emergency assistance to state and local agencies in order to control radiological hazards, protect the public health and safety, and minimize the loss of property. This plan is an integral part of a nationwide program of radiological assistance established by the US DOE, and is implemented on a regional basis. The Brookhaven Area Office (BHO) Radiological Assistance Program is applicable to DOE Region I, which consists of the New England States, New York, New Jersey, Pennsylvania, Delaware, Maryland and the District of Columbia. The BHO RAP-1 has been developed to: (a) ensure the availability of an effective radiological assistance capability to ensure the protection of persons and property; (b) provide guidelines to RAP-1 Team personnel for the evaluation of radiological incidents and implementation of corrective actions; (c) maintain liaison with other DOE installations, Federal, State and local organizations which may become involved in radiological assistance operations in Region I; and (d) encourage development of a local capability to cope with radiological incidents.

25435 **(DPST—83-622-Rev.1) Recreational use of the Savannah River.** Hutto, G.A.; Turcotte, M.D.S. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 20 Oct 1983. Contract AC09-76SR00001. 24p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86008043.

Recreational use of the Savannah River contributes very little to the population dose received from liquid releases during normal operations at SRP. However, due to the lack of site-specific data in the past for recreational use parameters, there was some uncertainty in the dose calculation for recreational activity. Data have recently become available which can yield site-specific estimates of recreational use. The estimates derived from the creel survey data show that the previous parameters used for recreational activity overestimate actual use. The standard error upper limits of the creel survey estimates of 231,987 person-hrs/yr and 108,395 person-hrs/yr, are well below the previously estimated recreational use values of 700,000 persons-hrs/yr for boating and 200,000 person-hrs/yr for shoreline activities respectively. The creel survey estimate of 8465 person-hrs/yr is considerably lower than the previously used value for swimming activity, 100,000 person-hrs/yr. Use of these site specific estimates in future dose calculations will significantly decrease the calculated population dose due to recreational use of the Savannah River.

25436 **(GJ/TMC—12) Procedure manual for the estimation of average indoor radon-daughter concentrations using the Radon Progeny Integrating Sampling Unit (RPISU) method.** Langner, G.H. Jr. (Bendix Field Engineering Corp., Grand Junction, CO (USA)). Feb 1986. Contract AC07-76GJ01664. 69p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE86008794.

One of the remedial-action measurement needs is the estimation of average indoor radon-daughter concentration (RDC). One method for accomplishing such estimations in support of DOE remedial action programs is the Radon Progeny Integrating Sampling Unit (RPISU) method. This procedure manual describes how to set up and operate a system for obtaining RPISU measurements, and how to derive average RDC estimates from those measurements. The accuracy of the RPISU measurements is verified through use of appropriate quality-assurance and -control procedures as described in this manual. These include periodic calibrations, sensitivi-

ty checks, and annual cross-comparisons (with the Technical Measurements Center, for example), as well as adequate documentation of all measurements, sensitivity checks, calibrations, and intercomparisons. 19 refs., 18 figs., 1 tab.

25437 **Exposure and risk calculations for disposal of wastes having minimal radioactivity.** Fields, D.E. (Health and Safety Research Division, Oak Ridge National Laboratory, Oak Ridge, TN). pp 661-664 of Waste isolation in the US, technical programs and public education. Vol. 1. La Grange Park, IL; American Nuclear Society (1984). (CONF-840307—).

From Waste management '84; Tucson, AZ, USA (11 Mar 1984).

The US Nuclear Regulatory Commission is currently considering revision of rules 10 CFR 20 and 10 CFR 61, which cover disposal of solid wastes containing minimal activity radioactivity. In support of these revised rules, we have evaluated the consequences of disposing of four waste streams at four types of disposal areas located in three different geographic regions. Consequences are expressed in terms of human exposures and associated health effects. Each geographic region has its own climate and geology. Example waste streams, waste disposal methods, and geographic regions chosen for this study are clearly specified. The PRESTO-II methodology was used to evaluate radionuclide transport and health effects. This methodology was developed to assess radiological impacts to a static local population for a 1000-year period following disposal. The modeling of pathways and processes of migration from the trench to exposed populations included the following considerations: groundwater transport, overland flow, erosion, surface water dilution, resuspension, atmospheric transport, deposition, inhalation, and ingestion of contaminated beef, milk, crops, and water.

0550 Regulations

REFER ALSO TO CITATION(S) 25407, 25409

25438 **(DOE/DP—0001/17) Strategic special nuclear material Inventory Differences. Semiannual report, October 1, 1984-March 31, 1985.** (USDOE Assistant Secretary for Defense Programs, Washington, DC. Office of Safeguards and Security). Jan 1986. 35p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86007209.

This seventeenth periodic semiannual report of unclassified Inventory Differences (ID) covers the first six months of fiscal year 1985 (October 1, 1984, through March 31, 1985), for all key Department of Energy (DOE) and DOE contractor operated facilities possessing strategic special nuclear materials. Data for the Rocky Flats and Y-12 nuclear weapons production facilities are not included in the report in order to protect classified nuclear weapons information; however, classified ID data from these facilities receive the same scrutiny and analyses as the unclassified data. The data in this report have been prepared and reviewed by DOE contractors, field offices, and Headquarters. When necessary, special investigations have been performed in addition to these reviews. The ID data, explanations, reviews, and any additional special investigations, together with the absence of physical indications of any theft attempt, support a finding that no theft or diversion of significant quantities of strategic special nuclear material has occurred in DOE facilities during the six-month period covered by this report.

25439 **(LA—10615-M) Plutonium Canister Counter operations and procedures manual.** Menlove, H.O.; Adams, E.L.; Dahn, E.; Ramalho, A. (Los Alamos National Lab., NM (USA)). Feb 1986. Contract W-7405-ENG-36. 40p. (ISPO—216). NTIS, PC A03/MF A01; GPO Dep. File Number DE86008574.

A neutron coincidence counter has been designed for the measurement of plutonium powder contained in storage canisters. Each canister contains from one to four cans of mixed oxide. The neutron counter measures the spontaneous fission rate from the plutonium, and when this is combined with the plutonium isotopic ratios, the plutonium mass is determined. The system can accommodate plutonium loadings up to 8 kg, with 4 kg being a typical loading. This manual describes the system and its operation and gives performance and calibration parameters for typical applications. 5 refs., 10 figs., 8 tabs.

25440 **(LA—10633-MS) Applications guide to pedestrian SNM monitors.** Fehlau, P.E. (Los Alamos National Lab., NM (USA)). Feb 1986. Contract W-7405-ENG-36. 60p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE86008571.

The applications guide introduces readers to the pedestrian special nuclear material (SNM) monitors that provide nuclear material control at DOE contractor facilities. It explains the principles of operation, the strong and weak points, and steps for calibration and maintenance of the monitors. Administrators and security specialists will find an overview of pedestrain monitor application and upkeep in Part 1 of the guide and a descriptive catalog of present-day monitors in Part 3. Technically oriented readers will be interested in the more detailed discussion of SNM monitoring physics and SNM monitor design principles found in Part 2. 18 refs., 33 figs., 9 tabs.

25441 **(SAND—85-2059) Designing and implementing integrated high security physical protection systems. The Sandia experience.** Caskey, D.L. (Sandia National Labs., Albuquerque, NM (USA)). Feb 1986. Contract AC04-76DP00789. 24p. (CONF-860519—3). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86006259.

From Carnahan conference on security; Lexington, KY, USA (14 May 1986).

As DOE's lead laboratory for physical security, Sandia National Laboratories has had a major physical security program for over ten years. Activities have ranged from component development and evaluation, to full scale system design and implementation. This paper presents some of the lessons learned in designing and implementing state-of-the-art high security physical protection systems for a number of government facilities. A generic system design will be discussed for illustration purposes. Sandia efforts to transfer technology to industry will be described. 2 refs., 5 figs.

25442 **(SAND—85-2234C) Vehicle barrier systems.** Sena, P.A. (Sandia National Labs., Albuquerque, NM (USA)). 1986. Contract AC04-76DP00789. 14p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86005888.

The ground vehicle is one of the most effective tools available to an adversary force. Vehicles can be used to penetrate many types of perimeter barriers, transport equipment and personnel rapidly over long distances, and deliver large amounts of explosives directly to facilities in suicide missions. The function of a vehicle barrier system is to detain or disable a defined threat vehicle at a selected distance from a protected facility. Numerous facilities are installing, or planning to install, vehicle barrier systems and many of these facilities are requesting guidance to do so adequately. Therefore, vehicle barriers are being evaluated to determine their stopping capabilities so that systems can be designed that are both balanced and capable of providing a desired degree of protection. Equally important, many of the considerations that should be taken into account when establishing a vehicle barrier system have been identified. These considerations which pertain to site preparation, barrier selection, system integration and operation, and vehicle/barrier interaction, are discussed in this paper. 2 tabs.

25443 **(SAND—85-2236) Airborne intruder detection considerations.** Syler, R.P. (Sandia National Labs., Albuquerque, NM (USA)). Feb 1986. Contract AC04-76DP00789. 5p. (CONF-860519—4). NTIS, PC A02/MF A01; GPO Dep. File Number DE86006462.

From Carnahan conference on security; Lexington, KY, USA (14 May 1986).

This paper addresses the considerations the DOE-OSS is giving to the airborne threat to their sensitive facilities. They are working towards establishing prohibited airspace over these facilities and taksed SNL to study the techniques for monitoring this airspace. The SNL study looked at various technologies that might be employed to monitor designated airspace. The results of the study indicate that certain dedicated radar systems are candidates, but that alternatives to these are needed. SNL is presently working on

developing a system utilizing FAA ASR data at the DOE facilities, and on a seismic-acoustic helicopter detector system; these are possible alternatives to dedicated radars. 3 refs.

25444 **Applications of a transportable spent-fuel measurement system.** Halbig, J.K.; Bosler, G.E.; Klosterbuer, S.F.; Rinard, P.M. (Los Alamos National Laboratory, Los Alamos, NM 87545). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-33**: No. 1, vp(Feb 1986). (CONF-851010—).

From Symposium on nuclear power systems; San Francisco, CA, USA (23 Oct 1985).

The ION-I/Fork detection system described here was developed to measure spent-fuel assemblies for the International Atomic Energy Agency (IAEA). This transportable, battery-operated system is being widely used by the IAEA and by other safeguards agencies throughout the world. It has had very limited use and exposure domestically, however. This paper describes the system and points out some possible areas of domestic application.

07 Radiation Sources

REFER ALSO TO CITATION(S) 26548

08 HYDROGEN

0801 Production

25445 **Method for improving product yields in an anionic metalloporphyrin-based artificial photosynthesis system.** Shelnutt, J.A. (to Dept. of Energy). US Patent 4,568,435. 4 Feb 1986. Filed date 29 Nov 1984. vp.

This patent describes a method for improving product yield in an anionic metalloporphyrin-based artificial photosynthesis system for hydrogen generation. The method consists of: forming an aqueous solution comprising an electron donor, methylviologen, and a metalloporphyrin or metallochlo-irradiating the aqueous solution with light in the presence of a catalyst.

09 OTHER SYNTHETIC AND NATURAL FUELS

0901 Hydrocarbon Fuels

REFER ALSO TO CITATION(S) 25275

25446 **(DOE/FC/10625—2029) Biological degradation of low-rank coal. Quarterly technical progress report, September 30-December 31, 1985.** Jones, W.J. (Georgia Inst. of Tech., Atlanta (USA). School of Applied Biology). Feb 1986. Contract AC18-85FC10625. 25p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86008842.

The Statement of Work for year one activities under contract AC1885FC10625 requests that an assessment of low-rank coal biodegradation be completed early in the contract period. This goal has been undertaken and the following text includes pertinent information, primarily from available literature, related to (1) coal chemistry, structure and composition, with primary emphasis on low-rank coals (primarily lignite and subbituminous); (2) physical and/or chemical treatment of coal to enhance biodegradability; and (3) anaerobic processes for bioconversion of low-rank coal or related constituents to fuel products such as methane. Information acquired from this assessment will aid in the selection of model compounds, representative of organic compounds found as relevant constituents of low-rank coal, to be used in initial biodegradation experiments and will be invaluable in attempts to establish microbial cultures capable of bioconversion of the model compounds to methane. 67 refs., 5 figs., 1 tab.

25447 **(DOE/PC/80536—T2) New method of magnetic characterization of zeolite-cobalt catalysts. Second quarterly technical progress report, December 1, 1985-February 28, 1986.** Murty, A.N. (Grambling State Univ., LA (USA)). 31 Mar 1986. Contract FG22-85PC80536. 9p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86008783.

This report describes the work carried out during the project period from December 1, 1985 through February 28, 1986. The results of our investigations on a series of cobalt and cobalt thoria catalysts physically admixed with the medium pore zeolite ZSM-5 are presented. The preparation of the catalysts and the catalytic measurements were carried out at the Pittsburgh Energy Technology Centre of the Department of Energy and the Zero-field Nuclear Magnetic Resonance experiments were made at Grambling State University using a modified Wilks Nuclear Quadrupole Resonance spectrometer, described in the previous report. The catalytic measurements revealed that the hydrocarbon yields increase from about 35% to 60% as the cobalt metal loading in ZSM-5 increases from 3 wt % to 9 wt %. When a small amount of the promoter Thoria (0.4 wt %) is added, the hydrocarbon yields increased significantly (by about 25%), for the same weight percents of cobalt in Co-ZSM-5. The primary objective of our project is to examine the effect on the Ferromagnetic character of the cobalt metal due to the (1) concentration of Co metal in ZSM-5, (2) presence of the promoter Thoria, and (3) catalytic activity. 12 refs.

25448 **(PNL—5798-2) Conversion of forest residues to a methane-rich gas. Detailed economic feasibility study.** (Battelle Columbus Labs., OH (USA)). Mar 1986. Contract AC06-76RL01830. 79p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE86008520.

An economic evaluation of the application of the multi-solid fluid reactor design to wood gasification was completed. The processing options examined include plant capacity, production of a high-Btu (1006 Btu/SCF HHV) gas versus an intermediate-Btu gas (379 Btu/SCF HHV), and operating pressure. 9 figs., 29 tabs.

25449 **(PNL—5798-3) Conversion of forest residues to a methane-rich gas.** Feldmann, H.G.; Paisley, M.A.; Appelbaum, H.R. (Battelle Columbus Labs., OH (USA)). Mar 1986. Contract AC06-76RL01830. 48p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86008521.

A process is being developed that produces a fuel gas with a heating value of 500 Btu/SCF from diverse forms of biomass, including shredded bark, wood chips, and sawdust. The system uses a high throughput, non-oxygen gasifier that employs sand circulation to supply process heat. Results obtained with a 10-inch I.D. gasifier are presented and compared with those in a 6-inch I.D. reactor. Feed rates up to 12 tons/day (dry) have been achieved corresponding to a specific wood throughput of 2000 lbs/ft^2-hr. Gas compositions in the two reactors are in excellent agreement and performance in the larger reactor, as measured by carbon conversion, is significantly improved. Cost projections comparing this process with direct combustion are presented that indicate gasification technology should have very significant cost advantages for both generation of plant steam and cogeneration of electricity. 5 refs., 14 figs., 5 tabs.

25450 **(STEV-BF—85-10) Bioskiff. Final report, stage 1.** Martinell, R.; Moernester, O. (Statens Energiverk, Stockholm (Sweden)). Jul 1985. 32p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. File Number DE86751543.

An attempt to induce microbiological formation of methane using shale as a substrate in an anaerobic breakdown process, has been carried out in seven closed columns where water is used as a medium for transports. During the time past, methane-gas has accumulated in three of the columns.

25451 **(VTT-TUTK—337) Techno-economic assessment of direct biomass liquefaction processes.** McKeough, P.; Nissilae, M.; Solantausta, Y.; Bechman, D.; Oestman, A. (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)). Jan 1985. 141p. NTIS (US Sales Only), PC A07/MF A01. File Number DE86751565.

Processes being developed for the direct liquefaction of biomass were reviewed and six of them were selected for detailed assessment. These included both high-pressure and pyrolysis processes, employing both wood and peat as feedstocks. In the assessment, special attention was given to the technical uncertainties involved in the design of the processes. Production costs of primary liquids were calculated and the processes compared. Costs for upgrading two of the primary products into gasoline were also estimated. A high overall thermal efficiency to liquid products (of the order of 60%) can be obtained by both high-pressure and pyrolysis processes. The most promising process for the production of primary liquids is the Flash pyrolysis wood concept. The ratio of product cost/product value is about 1.5 at a wood cost of 30 USD/wet t. For the most promising high-pressure process (PERC) the ratios are 2.1 and 1.7 respectively. In the limit of zero feedstock cost, the ratio is about 0.6 for the Flash pyrolysis/wood process. On the basis of the estimated upgrading costs, it was not possible to decide which of the processes - Flash pyrolysis/wood or PERC/wood - is more promising for the production of transport fuels. The PERC process is the most technically certain of those studied. For all the processes, however, much more data has to be generated if the reliability of the process designs is to be significantly improved.

25452 **Design and construction of an energy intergrated farm system in Puerto Rico.** Sasscer, D.S.; Morgan, T.O. St. Joseph, MI; American Society of Agricultural Engineers (1984). 15p. (CONF-8406307—).

From Summer meeting on sustaining growth in agricultural productivity; Knoxville, TN, USA (24 Jun 1984).

An energy-integrated, environmental-compliance farm system was designed and constructed on a dairy farm in Puerto Rico. Electrical power is produced by a motor-generator fueled by biogas obtained from the anaerobic fermentation of cow manure. This well-managed system complies with both the letter and the spirit of local environmental laws.

0902 Alcohol Fuels

REFER ALSO TO CITATION(S) 25318

25453 **(DOE/CS/80010—T10) Integrated fuel alcohol production systems. Phase III. Experimental facility design report.** Barrier, J.W.; Badger, P.C.; Broder, J.D.; Farina, G.E.; Moore, M.R.; Forsythe, M.F. (Tennessee Valley Authority, Muscle Shoals, AL (USA). Office of Agricultural and Chemical Development). Feb 1985. Contract AI01-80CS80010. 147p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE86009064.

An overall objective is to develop and demonstrate ethanol production technology for small-scale production systems. The low-temperature, low-pressure, two-stage sulfuric acid process was selected because of its adaptability to small-scale production systems and because of the availability of research data for major process operations. Many processes require very large production facilities before they can be operated economically. The selected process (1) is batch operated requiring relatively simple control procedures and instrumentation, (2) operates at atmospheric pressure eliminating the need for pressure vessels and elaborate safety procedures, (3) requires relatively common process and materials handling equipment, and (4) is economical to construct and operate at the 10-gph scale. The low-temperature and pressure conditions allow widespread use of inexpensive fiberglass or plastic materials. 14 refs., 22 figs., 8 tabs.

25454 **(DOE/PC/70022—T1) Optimum higher alcohol mixtures for fuels from syngas. Fifth quarterly technical progress report.** (Union Carbide Corp., South Charleston, WV (USA). Research and Development Dept.). 27 Jan 1986. Contract AC22-84PC70022. 73p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE86008350.

The objective of the contract is to develop and evaluate novel homogeneous catalytic systems for the direct, selective conversion of low H_2:CO-ratio syngas to alcohol fuel extenders. Work on the project is divided into three tasks. Task 1 is the study and development of a ruthenium-based catalytic system for alcohol production discovered at Union Carbide. The effects of reaction components, including additives, co-catalysts, and solvents, on catalyst productivity and selectivity are being investigated. Task 1 work will continue throughout the contract period. Task 2 is the search for novel syngas conversion catalysts with improved performance. The major direction is toward metal systems not previously known to have significant catalytic activity in homogeneous CO hydrogenation reactions. Work on Task 2 is proceeding according to plan. Task 3 is a more detailed study of the most promising catalyst systems identified in Tasks 1 and 2. Investigations will be carried out on both fundamental and process levels. Work on Task 3 is beginning and will be described in the next quarterly report. The system presently being investigated in Task 3 is the novel methanol homologation system discovered under this contract. Progress reports are presented for the first two tasks.

25455 **(PB—86-143484/XAB) High-temperature dilute-acid hydrolysis of waste cellulose: batch and continuous processes. Final report, 25 June 1977-31 March 1981.** Brenner, W.; Rugg, B. (New York Univ., NY (USA). Dept. of Applied Science). Nov 1985. 115p. (NYU/DAS—80-21/B). NTIS, PC A06/MF A01.

The 5-year investigation on the dilute acid hydrolysis of waste cellulose to glucose has emphasized the crucial step of continuously converting cellulose to glucose. Initial batch studies emphasized pretreatments to improve accessibility of the cellulose, and established suitable reaction conditions. Later a 1-ton/day pilot plant was designed and constructed based on the application of a Werner & Pfleiderer Twin Screw Extruder Reactor to demonstrate this approach. The process was tested using paper pulp (at 10% solids) and dry hardwood sawdust (at 95% solids). Attractive energy efficiencies and high conversion yields resulted. Up to 60% glucose conversion was achieved, based on the available cellulose values without pretreatment. The report presents a scheme for a continuous, production-scale acid hydrolysis-fermentation facility based on a waste cellulose feedstock for production of fuel-grade ethanol.

25456 **(PB—86-144490/XAB) Two-stage, dilute sulfuric acid hydrolysis of wood: an investigation of fundamentals. Forest Service general technical report (Final).** Harris, J.R.; Baker, A.J.; Conner, A.H.; Jeffries, T.W.; Minor, J.L. (Forest Service, Madison, WI (USA). Forest Products Lab.). Oct 1985. 78p. (FSGTR-FPL—45). NTIS, PC A05/MF A01.

The paper presents a fundamental analysis of the processing steps in the production of ethanol from southern red oak (Quercus falcata Michx) by two-stage dilute sulfuric acid hydrolysis. Data for hemicellulose and cellulose hydrolysis are correlated using models. The information is used to develop and evaluate a process design.

25457 **(TVA/OACD—85/5) Use of ethanol production by-products for producing microalgae, tilapia, and freshwater prawns.** Behrends, L.L.; Kingsley, J.B.; Price, A.H. III. (Tennessee Valley Authority, Muscle Shoals, AL (USA). Office of Agricultural and Chemical Development). 1983. 35p. NTIS, PC A03/MF A01. File Number DE86901147.

By-products from fermentation of grains to alcohol are highly valued as feed supplements for beef and dairy cattle, swine, and poultry. The quantity of wet distillers by-products (stillage) from fuel alcohol production is expected to increase greatly. Unlike dried distillers by-products, wet distillers by-products have generally been abandoned as feed supplements for livestock because of high water content, cost of handling, and storage problems. Using wet distillers by-products as a fertilizer or feed supplement in aquatic production systems appears promising. Two experiments were conducted to determine relationships between stillage application rates and production of microalgae and yields of tilapia (fish) and freshwater prawns (shrimp). Dissolved oxygen concentrations and several other water quality parameters were also monitored. 19 refs., 3 figs., 17 tabs.

0904 Solid Waste And Wood Fuels

REFER ALSO TO CITATION(S) 25739, 26017

25458 (STEV-SB—85-6) Chiptub. Alexandersson, H. (Statens Energiverk, Stockholm (Sweden)). May 1985. 15p. (In Swedish). NTIS (US Sales Only), PC A02/MF A01. File Number DE86751549.

The report describes the evaluation of a prototype of a dumper designed for transport of fuel chips between a movable chipper and the banking ground. The dump body is made of aluminium in order to reduce the weight. The weight reduction is 1.5-2 tons.

13 HYDRO ENERGY

1305 Economics And Management

25459 (DOE/ID/12254—1-Vol.4) Small hydropower development: the process, pitfalls, and experience. Volume 4. Guide for developers. Christensen, J.P.; Cunningham, C.H.; Eanes, T.S.; Engebretsen, A.R. (Morrison-Knudsen Engineers, Inc., San Francisco, CA (USA)). Dec 1985. Contract AC07-82ID12254. 225p. NTIS, PC A10/MF A01; 1; GPO Dep. File Number DE86008333.

This fourth and final volume of a series prepared under the Small Hydropower Technology Transfer Project guides the utility or private developer of small hydropower projects through the various stages of the development process and addresses such key issues as project planning, environmental considerations, regulatory requirements, estimating costs and benefits, economics, financing, power sales, contracting strategies, operation and maintenance. Specific recommendations are given to help the developer in making informed decisions, avoiding potential pitfalls, and in expediting the development process.

14 SOLAR ENERGY

REFER ALSO TO CITATION(S) 25956

1401 Resources And Availability

25460 (NP—6751629) Radiation measuring results in the Federal Republic of Germany and special measuring results obtained at the Hamburg Meteorological Observatory. Vol. 8(1983). (Deutscher Wetterdienst, Hamburg (Germany, F.R.). Meteorologisches Observatorium). 1984. 183p. (In German). NTIS (US Sales Only), PC A09/MF A01. File Number DE86751629.

The meteorological authorities of the Federal Republic of Germany currently dispose of a radiation network equiped with 28 metering stations. While total solar radiation is measured separately by 13 stations, diffuse radiation is measured by 15. The publication abstracted contains a tabular survey of measuring data obtained in 1983. As against previous publications the following alterations may be noted: On and after the 1st of May 1983 aerosol mass concentration is measured by means of the Frieseke und Hoepfner FH 6212 dust monitor. Since the beginning of 1983 particles and macroparticles are collected fractionally. The concentration of hydrogen ions and water-soluble inorganic ions is analysed and determined separately. (BR).

25461 (TNO-TPD—327226-2) Indoor characterization and calibration and outdoor calibration of seven IEA-pyranometers in the framework of IEA task IX-c. Van den Brink, G.J.; Kratz, P.; Van Wely, L.F. (Nijverheidsorganisatie TNO, Delft (Netherlands). Technisch Physische Dienst). Oct 1985. 86p. TPD TNO-TH, P.O. Box 155, 2600 AD Delft, Netherlands.

This report describes part of the research work carried out under contract with the Dutch Management Office for Energy Research, within the framework of task IX, subtask C, of the IEA solar heating and cooling programme. It concerns the indoor characterization and calibration and outdoor calibration of a set of seven IEA pyranometers. The main part of the indoor measurements was carried out by Kipp en Zonen, the remaining measurements were carried out by the TNO Institute of Applied Physics. The results which are presented concern the main pyranometer characteristics and the sensitivities which should be used for outdoor measurements. A format which can be used for the presentation of the characterization and calibration of pyranometers is part of this report. (A.V.)

1405 Solar Energy Conversion

REFER ALSO TO CITATION(S) 25445, 25452, 25455, 25739, 26159, 26358

25462 (CONF-860405—1) Role of genetic improvement in the Short Rotation Woody Crops Program. Layton, P.A.; Wright, L.L. (Oak Ridge National Lab., TN (USA)). 1986. Contract AC05-84OR21400. 32p. NTIS, PC A03/MF A01; GPO Dep. File Number DE86008541.

From 10. annual symposium on energy from biomass and wastes; Washington, DC, USA (7 Apr 1986).

A major effort in the Short Rotation Woody Crops Program (SRWCP) is species screening and genetic improvement of selected species. Of the 125 species initially evaluated for SRIC, 20 are being seriously considered with most of emphasis on 16 hardwood species. Range-wide seed collections of 12 species were provenance tested; these include Platanus occidentalis (sycamore), Alnus glutinosa (European black alder), and Robinia pseudoacacia (black locust). Based on the results of these tests, highly productive, site-specific seed sources are being chosen for several geographic regions. Three of these species re currently being bred for increased productivity in SRIC systems. Genetic improvement is viewed as a tool for increasing productivity, having anticipated gains of 40 to 50%. The techniques of somaclonal screening and genetic engineering are being evaluated for their usefulness in the SRIC improvement program. Currently, salt-tolerant Atriplex canescens (four-wing saltbush) and herbicide-resistant Populus spp. are being sought via somaclonal screening. 35 refs., 4 figs., 3 tabs.

25463 (CONF-860405—2) Potential for growing terrestrial energy crops in the Southwest United States. Salk, M.S.; Folger, A.G. (Oak Ridge National Lab., TN (USA); Solar Energy Research Inst., Golden, CO (USA)). 1986. Contract AC05-84OR21400. 42p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86009154.

From 10. annual symposium on energy from biomass and wastes; Washington, DC, USA (7 Apr 1986).

The southwest US was assessed to determine which parts of the region would be suitable for growing terrestrial energy crops and then to characterize those areas. Minimal conditions for biomass energy crop production were considered to be an average annual precipitation of at least 30 cm (12 in.) and a frost-free period of at least 120 days per year. Approximately 7.7×10^7 ha (19.1×10^7 acres), just over 40% of the study region, met both criteria. 33 refs., 4 figs., 4 tabs.

25464 (DOE/ER/12072—T1) Planar flow casting of sheet silicon for photovoltaic cells. Final report, August 1, 1983-September 30, 1984. (Solamat, Inc., East Providence, RI (USA)). 30 Sep 1984. Contract AC02-82ER12072. 65p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE86007433.

The objective of this research program is to develop a casting process for polycrystalline silicon ribbons so that ribbons suitable for photovoltaic use can be directly produced from the melt, thus avoiding the need for the slicing and the polishing steps commonly required when silicon crystals are grown by Czochralski method or when silicon blocks are cast. In addition, the aim of this project is to develop a casting process which employs conduction as the mode of heat transfer, so that the silicon ribbons can be cast at a higher casting speed than that is possible with EFG, WEB, and the LASS processes where the casting speeds are restricted to between 0.1 and 2 feet per minute. In these processes, heat is first conducted away through the silicon ribbon along the length and then radiated. In our research program we have explored methods

to extract heat through the thickness of the ribbon by conduction similar to that accomplished in rapid solidification processes. Silicon ribbons have been cast in this manner. These thin ribbons did not provide optimum solar energy conversion efficiencies. In the course of this research program we have taken three rapid solidification approaches to produce polycrystalline silicon ribbons. These processes are (1) Jet Casting, (2) Modified Planar Flow Casting, and (3) Double-Roller Quench Casting. In these casting processes silicon ribbons were produced in ambient as well as in an inert atmosphere. The inert atmosphere was produced by first evacuating a custom designed chamber with a mechanical vacuum pump and then backfilling the chamber with the desired inert gas.

25465 **(DTH-EI-LHT—117) Report on cheap processes for fabrication of silicon solar cells of high efficiency.** Safir, Y.; Proctor, W.G.; Leistiko, O. (Danmarks Tekniske Hoejskole, Lyngby. Elektronisk Inst.). Jan 1984. 18p. (In Danish). NTIS (US Sales Only), PC A02/MF A01. File Number DE86751518.

The pingroject is aimed at develop a process for fabrication of reproducible, stable silicon solar cells with high efficiency. A cheap and simple technology should substitute the present one without deterioration of the cell performance. The process here developed has used a spin-on doping, belt furnace instead of a quartz furnace tube, serigraphy instead of photolitography and surface treatment with a special edge protection techniques instead of various unstable methods for pn-transition isolating. The cell area has been enlarged from 5 cm^2 to 20 cm^2 and a procedure for p^+nn^+ cells and n^+pp^+ cells is developed. The best textured p^+nn^+ had Jsub(SC) = mA/cm^2, Vsub(oc) = 603 mV, FF = 0.78, itasub(AM)$_1$ = 11.8%. Typical values for n^+pp^+ cells inclusive AR layer was Jsub(SC)= 23.9 mA/cm^2, Vsub(oc) = 592 mV, FF = 0.77, itasub(AM)$_1$ = 11.0%. A solar cell panel with 6 n^+pp^+ cells gave Isub(SC) = 440 mA, Vsub(oc) - 3.5 V. Commercial monocrystalline solar cells are now generally of n^+pp^+ type and have coefficient of performance from 12 to 15% while cell area is varying from 20 to 80 cm^2.

25466 **(EPRI-AP—4464) PG and E photovoltaic module performance assessment. Final report.** Hoff, T.E.; Matsuda, K.M.; Betts, E.G. (Pacific Gas and Electric Co., San Ramon, CA (USA). Dept. of Engineering Research). Mar 1986. 128p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI86920217.

Pacific Gas a040744d Electric Company's Department of Engineering Research has a Photovoltaic Test Facility in San Ramon, California that monitors the performance of twenty-six modules and a 2.6 kWp array. The testing includes fixed flat-plate, two-axis tracking flat-plate, and concentrator modules.

25467 **(JU-PS—7) Photosynthesis, respiration and peat accumulation: CO_2 exchange approach to mire ecology.** Silvola, J. (Joensuu Univ. (Finland)). 1985. 15p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86751574.

This paper reviews five articles by the author on photosynthesis in certain mire plants and soil respiration in peat, two processes whose difference can be regarded in a somewhat generalized form as representing peat accumulation. The results of the photosynthesis measurements are presented in terms of the photosynthetic rate in relation to light intensity, temperature, CO_2 concentration and water content of the plant. A means of estimating the balance of organic material in mires is presented and the role of peatlands in the increase of atmospheric carbon dioxide is briefly discussed.

25468 **(KFK-PEF—2, pp 275-284) Studies on cell wall structures of wood from diseased trees for an assessment of wood quality.** Fengel, D. (Muenchen Univ., Germany, F.R. Inst. fuer Holzforschung). Apr 1985. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86751479. (CONF-8503225—).

From 1. status colloquium of the European Research Center project for air pollution abatement measures (PEF) of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (5 Mar 1985).

Methods planned for use in the project were tested using samples from different annual ring sections of the trunk cross-section of a healthy and a diseased spruce tree from Forstamt Bodenmais (Bayerischer Wald). So far, observations made by scanning and transmission electron microscopy revealed no conspicuous changes in tissue and cell structures of samples from the affected tree. On extraction of finely ground wood by means of hexafluoropropanol-water, the samples from the sapwood of the affected tree yielded a higher extract proportion than corresponding samples from the healthy tree. Examinations were supplemented to by IR-spectrometry measurements.

25469 **(PB—86-121399/XAB) Roots of plantation cottonwood: their characteristics and properties. Forest Service research note.** Francis, J.K. (Forest Service, New Orleans, LA (USA). Southern Forest Experiment Station). Aug 1985. 6p. (FSRN-SO—314). NTIS, PC A02/MF A01.

The root biomass and its distribution and the growth rate of roots of pulpwood-size cottonwood (Populus deltoides) in plantations were estimated by excavation and sampling.

25470 **(PB—86-144946/XAB) Forest statistics for Vermont, 1973 and 1983. Forest Service resource bulletin (Final).** Frieswyk, T.S.; Malley, A.M. (Forest Service, Broomall, PA (USA). Northeastern Forest Experiment Station). 1985. 108p. (FSRB-NE—87). NTIS, PC A06/MF A01.

A statistical report on the fourth forest survey of Vermont (1983). Findings are displayed in 81 tables containing estimates of forest area, numbers of trees, timber volume, tree biomass, and timber products output. Data are presented at three levels: state, geographic unit, and county.

25471 **(PB—86-902000/XAB) Government research and development summaries: solar project briefs. Monthly report.** (Interagency Advanced Power Group, Fort Belvoir, VA (USA)). 1986. vp. NTIS.

The area focuses on solar radiation collection storage and conversion to heat or other energy forms. Photovoltaic and solar thermal devices and related systems are also reported.

25472 **(SAND—85-0791/2) Summary of the Thirteenth Photovoltaic Concentrator Project Integration Meeting.** (Sandia National Labs., Albuquerque, NM (USA)). Aug 1985. Contract AC04-76DP00789. 68p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE86008878.

This report is a brief summary of the Thirteenth Photovoltaic Concentrator Project Integration Meeting sponsored by Sandia National Laboratories. Highlights in each of the three primary Concentrator Research Tasks, Cell Research, Module Research, and Array Development are discussed.

25473 **(SAND—85-7022) SIPOS heterojunction contacts to silicon.** Kwark, Y.H.; Swanson, R.M. (Stanford Univ., CA (USA). Stanford Electronics Labs.). Feb 1986. Contract AC04-76DP00789. 275p. NTIS, PC A12/MF A01; 1; GPO Dep. File Number DE86008879.

Deliberate introduction of controlled amounts of an oxygen-bearing species such as nitrous oxide into the deposition ambient normally used for chemical vapor deposition of polysilicon produces SIPOS, a class of silicon oxides that exhibits a wide range of physical properties. It is possible to tailor SIPOS film characteristics such as refractive index by altering the oxygen partial pressure in the deposition ambient. The addition of a dopant species converts these films from semi-insulating to a form that can be made sufficiently conductive after annealing to make them interesting for electronic applications. The potential for conveniently altering the effective mobility gap in this material suggests its use in heterojunction contact structures to silicon. Incorporation of these films into the emitter structure of an NPN bipolar transistor has been found to reduce the emitter saturation current fifty fold. This suppression of reverse injected hole transport has often been assumed to be the result of a wider gap in the SIPOS due to the presence of incorporated oxygen. However, this seems to be an oversimplification in view of microstructural studies that revealed a multi-phase structure consisting of a fine dispersion of silicon microcrystals embedded in an oxide-like matrix. Experimental results indicated a relative insensitivity to the oxygen content of the films; the hole blocking

action was as effective in low oxygen content film as in high. This insensitivity to bulk film properties implied that other mechanisms, in this case the formation of an interfacial oxide layer, may be primarily responsible for the reduced hole currents.

25474 **(SERI/CP—211-2875) Proceedings of the high-efficiency photovoltaic subcontractor's review meeting.** (Solar Energy Research Inst., Golden, CO (USA)). Jan 1986. Contract AC02-83CH10093. 210p. NTIS, PC A10/MF A01; 1; GPO Dep. File Number DE86004415.

Separate abstracts were prepared for 20 papers in these proceedings. Topics covered include high-efficiency solar cell concepts and crystalline silicon. (LEW)

25475 **(STEV—1985-9) Energy forestry. Results, conclusions and proposals from the Swedish energy forest research program.** (Statens Energiverk, Stockholm (Sweden)). 1985. 523p. (In Swedish). NTIS (US Sales Only), PC A22/MF A01. File Number DE86751541.

Sweden's energy research and development program has included backing for energy forest research and development since 1976. The aim of this program has been to analyse by 1985 the potential for the production and introduction of energy forest fuels in Sweden. In the present report, the National Energy Administration sets out the results obtained under the program, and presents its assessments of the future potential of energy forests, as well as putting forward proposals for continued R and D. The report was produced jointly by a reference group with representatives of the Stockholm School of Economics, The Swedish University of Agricultural Sciences, the Federation of Swedish Farmers, the forestry industry (MoDo AB), the National Swedish Environment Protection Board, the Swedish District Heating Association and the National Energy Administration. The report is in four parts: Part A, the main report, covers background, results summaries, assessments and proposals. The results obtained in the R and D program are presented in Part B. Part C deals with organizational matters, suitable areas for cultivation, fuel market and economics. Part D contains appendices.

25476 **(STEV-EO—85-12) Large scale energy forest cultivation in the South of Sweden. Final report stage 3.** Perman, G. (Statens Energiverk, Stockholm (Sweden)). Sep 1985. 70p. (In Swedish). NTIS (US Sales Only), PC A04/MF A01. File Number DE86751531.

The project deals with a large scale energy forest cultivation using Salix species under favourable climate and ground conditions. The experiment is carried out on farmland of 700000 m^3 outside the city of Malmoe in the southern part of Sweden. The plantation started in April 1983. First harvest is expected in December 1985. Today we have experience of plantation and two year operation. Environment research is conducted in the following areas. Water balance, water quality, fauna and landscaping. The economy of energy forest cultivation is determined in the project. The economy of the energy forest from cultivation to the energy production is estimated.

25477 **(STEV-SB—85-9) Processing of trees for recovery of forest energy. Final report.** Magnusson, L.; Joergensen, K.G. (Statens Energiverk, Stockholm (Sweden)). Nov 1985. 16p. (In Swedish). (TG—85-18). NTIS (US Sales Only), PC A02/MF A01. File Number DE86751532.

Teknikgruppen AB has proposed a new technique for the recovery of branches and tops from trees for energy use. A key component in this technique is a machine for delimbing full trees and feeding the branches and tops into a chipper. The machine is intended to work primarily at roadside. In order to demonstrate the technique a test machine has been built and tested. The tests confirm that delimbing of full trees can be carried out with a high production, that bundles of small trees can be delimbed (with a loss of delimbing quality), and that the branches and tops can be collected and fed onto the infeed conveyor of a chipper.

25478 **(TVA/OACD—84/10) Fuel production potential of several agricultural crops.** Mays, D.A.; Buchanan, W.; Bradford, B.N. (Skeist Labs., Inc., Livingston, NJ (USA)). Nov 1984. 41p. NTIS, PC A03/MF A01. File Number DE86901149.

Data collected on starch and sugar crops indicate that sweet potato and sweet sorghum have the best potential for alcohol production in the TVA area. Of the oil crops evaluated in this series of experiments only sunflower and okara appear to offer potential in the Tennessee Valley for oil production for fuel or other uses. 21 tabs.

25479 **Pulsed laser photocoulostatic studies of the gold/phthalocyanine Fe(CN)$_6$/sup -3,-4/ photoconductor electrode system.** Rieke, P.C.; Armstrong, N.R. (Los Alamos National Laboratory, Los Alamos, NM). pp 819 of Proceedings of the spring 1985 meeting of the Electrochemical Society. Pennington, NJ; Electrochemical Society (1985). (CONF-850542—).

From 167. Electrochemical Society meeting; Toronto, Ontario, Canada (12 May 1985).

The title system was investigated using pulsed dye laser photocoulostatics. By varying the direction and intensity of illumination, the Schottky barriers formed at the gold/dye and dye/Fe(CN)$_6$/sup -3,-4/ interfaces could be studied separately. The potential gradients at each interface were found to oppose one another, so that a potential well was formed in the dye layer. The depth of this well could then be quantitated, allowing the nonlinear potential gradient across the film to be defined for any bias potential. The implications for solar energy conversion are discussed.

25480 **Polymer solid electrolyte photoelectrochemical cells with n-Si-polypyrrole photoelectrodes.** Skotheim, T.A.; Inganas, O. (Dept. of Applied Science, Brookhaven National Laboratory, Upton, NY 11973). pp 117 of Proceedings of the spring 1985 meeting of the Electrochemical Society. Pennington, NJ; Electrochemical Society (1985). (CONF-850542—). Contract AC02-76CH00016.

From 167. Electrochemical Society meeting; Toronto, Ontario, Canada (12 May 1985).

The authors have developed photoelectrochemical cells based on junctions between n-Si photoelectrodes and thin films of solvent free polymer solid electrolytes based on poly(ethylene oxide) incorporating iodide redox couples. Bare n-Si is shown to be a highly irreversible electrode for iodide oxidation/reduction in this medium. By coating the n-Si electrode with thin films of iodide doped polypyrrole, the rate of charge transfer from the n-Si to the PEO electrolyte is enhanced by three orders of magnitude. Cells with conversion efficiencies in the 3-4% range based on 100 mW/cm^2 incident white light have been produced.

25481 **Porous counterelectrodes for polysulfide photoelectrochemical cells.** Winnick, J.; McLarnon, F.R.; Cairns, E.J. (Applied Science Div., Lawrence Berkeley Lab., Berkeley, CA). pp 938 of Proceedings of the spring 1985 meeting of the Electrochemical Society. Pennington, NJ; Electrochemical Society (1985). (CONF-850542—).

From 167. Electrochemical Society meeting; Toronto, Ontario, Canada (12 May 1985).

The aqueous sulfide/polysulfide redox couple has been shown to stabilize several semiconductors in photoelectrochemical cells. It is important to have an efficient (dark) counterelectrode in order to keep losses in these low voltage devices to a minimum. Performance data for porous counterelectrodes composed of metal sulfides in a hydrophilic carbon-teflon matrix are reported. The effects of pore structure, catalyst composition, catalyst material, catalyst loading, and electrolyte composition on performance are determined.

25482 **Formation of acetate using homoacetate fermenting anaerobic bacteria.** Ljungdahl, L.G. pp 219-248 of Organic chemicals from biomass. Wise, D.L. (ed.). London, England; Benjamin/Cummings Publishing Company, Inc. (1983).

Studies of the formation of acetic acid from renewable biological resources by fermentation of carbohydrates and other biomass materials by the action of acetogenic bacteria are reviewed. The physiology of the acetogenic bacteria, including metabolic pathways and enzyme studies, is discussed. The acetogenic bacteria included in the study are Clostridium aceticum, Clostridium thermoaceticum, Clostridium formicoaceticum, Acetobacterium woodii,

Clostridium thermoautotrophicum, and Acetogenium kivuii. The properties of the bacteria are tabulated and the substrate spectra are presented. The discussion of the pathway of acetate synthesis from CO_2 and H_2 deals mostly with C. thermoaceticum, but the evidence so far obtained indicates that the same pathway with minor modifications applies to other acetogenic bacteria. 103 references, 1 figure, 4 tables.

1406 Photovoltaic Power Systems

REFER ALSO TO CITATION(S) 25466

25483 (DOE/NASA/0310—1) Development of a microprocessor controller for stand-alone photovoltaic power systems. Millner, A.R.; Kaufman, D.L. (TriSolar Corp., Bedford, MA (USA)). Jun 1984. Contract AI01-76ET20485. 192p. (NASA/CR—174723). NTIS, PC A09/MF A01; 1; GPO Dep. File Number DE86008611.

As the cost of photovoltaic modules decreases, system control and related engineering costs become very important. To meet this need for flexibility with a minimum of customizing cost, and yet consume only a few watts of power is within the capabilities of today's microprocessor. The first unit was produced under DOE contract DEN3-310 and tested for NASA at TriSolarCorp. It is 5kW maximum power controlling battery charger which can also be configured as a 5kW batteryless motor drive. The entire controller interfaces with existing 500 watt MPC power modules, operates in a NEMA-4 enclosuer over an ambient temperature range of -25°C to +45°C, operates from either a 12V battery or a 40V to 300V dc unregulated solar array or battery bus. The unit design and cost are discussed, and testing is reported.

25484 (EPRI-AP—4466) Photovoltaic field test performance assessment. Technology status report No. 4. Final report. Mayorga, H.; Hostetler, R. (Boeing Computer Services Co., Tukwila, WA (USA). Engineering Technology Applications Div.). Mar 1986. 184p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI86920226.

Descriptions of 1984 performance are provided for five fixed-tilt flat plate, one tracking flat plate, and two concentrator photovoltaic systems. They range in size from 18 kW to 1000 kW. All of the systems have extensive instrumentation; performance readings are generally available every 10 minutes. Installations vary in energy efficiency. The older, fixed-tilt, flat plate sites have the lowest efficiency (5%). Next are the newer flat plate sites of both fixed-tilt and tracking types (6 to 7%). The Fresnel lens concentrator sites have the highest efficiency (6 to 9%). Installations vary widely in availability. Power conditioning unit failure is the largest contributor to decreased availability. In general, nameplate ratings are optimistic. Observed power output equals these ratings only under rare combinations of high insolation and low ambient temperature. Degradation in energy efficiency may be occurring at Oklahoma City. The tracking flat plate site demonstrates high energy capture and capacity factor. The Fresnel lens concentrators are especially sensitive to tracking error and cloudiness. At flat plate sites that have monocrystalline silicon cells, energy efficiency is fairly constant with insolation. At flat plate sites using polycrystalline cells, energy efficiency increases with insolation. At the Fresnel lens concentrator sites (both using monocrystalline cells), energy efficiency increases with insolation. Problems, mostly of the hardware type, with the on-site data acquisition system continue to hinder data collection.

25485 (ORNL/TM—9856) Space power using solar photovoltaic panels: costs and limitations. Williams, K.A. (Oak Ridge National Lab., TN (USA)). Mar 1986. Contract AC05-84OR21400. 80p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE86008953.

Solar photovoltaic panels (SPPs) have been suggested as a possible prime space power source for multi-kilowatt applications within a ballistic missile defense (BMD) system. As a first step in an attempt to assess the affordability of possible BMD space power sources, the limitations and costs of space power satellites using SSPs in conjunction with an electrochemical energy storage system have been investigated. Both high and low earth orbital missions are considered. An extensive literature search was conducted to determine values for the principal technology-driven performance and cost figures of merit. A small computer code was then developed to evaluate the total power cost, including launch, in dollars per watt of desired space power load. The unit costs obtained were found to be heavily influenced by the nature of the mission (altitude) and the attainable specific power for the two major system components.

1407 Solar Thermal Power Systems

REFER ALSO TO CITATION(S) 25497

25486 (ORNL—6218) Numerical study of the performance of latent heat storage for solar dynamic power systems. Solomon, A.D. (Oak Ridge National Lab., TN (USA)). Jan 1986. Contract AC05-84OR21400. 23p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86006748.

A conceptual design of a space station power system based on a Brayton cycle and solar powered has been developed. A key component of such a system is the thermal energy storage module, which is of crucial importance during periods of darkness. We have developed a computer program, FPAK1.F, simulating one possible storage design. We describe the code and, using it, raise some questions about the system under study.

25487 (SAND—86-8207) Evaluation of valve packing materials for long-term use in molten nitrate salt. Bradshaw, R.W. (Sandia National Labs., Livermore, CA (USA)). Mar 1986. Contract AC04-76DR00789. 37p. NTIS, PC A03/MF A01; GPO Dep. File Number DE86008837.

Chemical compatability between a number of compression packings and molten sodium nitrate-potassium nitrate was evaluated at temperatures of 288°C (550°F), 399°C (750°F), and 565°C (1050°F). The types of packing materials tested included graphite filaments, graphite ribbon, asbestos, teflon, aramid, glass and ceramic fibers, perfluorelastomers, and boron nitride. Packings were immersed for periods up to 1000 hours in a static test fixture which simulated their installation in a flow control valve stuffing box. Characteristics evaluated were visual indications of deterioration and salt absorption, weight change and microscopy of cross-sectioned samples. Several packings were chemically resistant to the molten salt at 288°C, but the compatibility of packings at 399°C and 565°C was not adequate. Thermogravimetric analysis demonstrated that oxidation of graphite by nitrate salt was slow at 288°C but increased rapidly at higher temperatures. The chemical and physical phenomena affecting compatibility are discussed and recommendations concerning materials selection are made.

25488 (SAND—86-8211) Technical feasibility study of a solid particle solar central receiver for high temperature applications. Hruby, J.M. (Sandia National Labs., Livermore, CA (USA)). Mar 1986. Contract AC04-76DR00789. 75p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE86008793.

This report summarizes work performed during a technical feasibility study of a solar central receiver in which free-falling solid particles directly absorb insolation and achieve temperatures greater than 550°C. The emphasis has been on receiver design and particle material selection, and the associated topics of free-falling particle cloud behavior and material evaluation techniques. The results of the study indicate that a free-falling solid particle receiver requires high incident flux levels, a small receiver aperture, and large particle volume fractions to achieve high efficiency. Terminal concentrators and aperture windows significantly increase solid particle receiver efficiency over traditional, north-facing cavity receiver designs. An inexpensive, alumina-based particle material has been indentified for use in a solid particle receiver at temperatures up to 1000°C. System components other than the receiver have also been briefly examined.

25480 **The performance of a hydrocarbon oil heat transfer fluid in the thermal storage system at Solar One.** Faas, S.E.; Thorne, L.R. (Sandia National Laboratories, Livermore, CA). pp 214-218 of Solar Engineering - 1985 (AAAJ). Bannerot, R.B. New York, NY; American Society of Mechanical Engineers (1985). (CONF-850306—).

From Solar energy conference–1985; Knoxville, TN, USA (25 Mar 1985).

Hydrocarbon oils are commonly used as the heat transfer and storage medium for low temperature (150 to 320°C) sensible heat storage systems in solar thermal power plants. These oils are subject to degradation and loss of mass due to the elevated temperatures at which they operate. The Exxon Corporation product called Caloria HT-43 has been used for 1.5 years in the Thermal Storage System of Solar One, a 10 MWe solar thermal central receiver pilot plant under test near Daggett, CA. Caloria HT-43 is a very complex mixture of paraffins with no single component having a concentration greater than 1 percent. Analyses of the oil composition are difficult to interpret as a result, but do indicate little chemical change has occurred. The mechanism for decomposition cannot yet be determined. The measured mass loss of Caloria for 1983 is 26,000 kilograms or about 4.5 percent of the initial inventory of approximately 575,000 kilograms. Three different mass loss prediction equations based on laboratory experiments were used with the oil temperature history for 1983 to predict the mass loss. Two of the three equations yield mass loss predictions that agree within 15 to 23 percent of the measured mass loss. The density, viscosity, and specific heat of fresh Caloria and of 14 month old Caloria were measured. These properties have changed, at most, 65 percent from new to aged in this time period.

1408 Ocean Energy Systems

25490 **(AD-A—163328/8/XAB) OTEC (ocean thermal energy conversion) current study. Final report.** (Naval Facilities Engineering Command, Washington, DC (USA). Chesapeake Div.). Mar 1979. 68p. (CHES/NAVFAC-FPO—1-79(7)). NTIS, PC A04/MF A01.

A fundamental element of all currently proposed Ocean Thermal Energy Conversion (OTEC) systems is a long, large-diameter cold-water pipe (CWP) that will serve as a conduit for cold water from the ocean depths to a heat exchanger at or near the surface. There will be various envirommental forces acting upon the CWP. Those of primary concern are on the wave action on the CWP suspension system at the surface, and the ocean current hydrodynamic forces on the pipe itself throughout its length. The latter is the subject of this report. A string of current meters with the necessary buoy and anchor accessories was designed. It comprised eight Aanderaa current meters, 100 feet apart, suspended from a 40 inch diameter subsurface buoy and anchored to the bottom as shown. Contents: Installation Preparation; Installation of the Current Meter String; Current Meter Characteristics and Operation; Recovery and Inspection of Current Meters; Processed Results of Measured Data; Pressure and Temperature Data; Current Velocity and Direction; Vector Diagrams of Currents at Various Depths; Spectrum Analysis of Current Velocities; Interpretation of Plotted and Tabulated Data.

1409 Solar Thermal Utilization

REFER ALSO TO CITATION(S) 25471, 25777, 25779, 25782, 25784

25491 **(DOE/CS/30259—T2) [Experimental passive solar heating and cooling systems]. Final report.** Burns, P.J. (Colorado State Univ., Fort Collins (USA). Dept. of Mechanical Engineering). Jun 1985. Contract AC02-80CS30259. 54p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE86008260.

A building was designed to be representative of a large residential, small commercial, 2-story structure. The design included internal reconfigurability for the testing of a wide variety of passive solar systems. (BCS)

25492 **(DOE/CS/30329—T2) Passive solar commercial buildings design assistance and demonstration program. Mount Airy Public Library. Phase 2 and 3. Final report.** (Mount Airy, City of, NC (USA)). 23 Sep 1984. Contract FC02-80CS30329. 93p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE86008554.

The construction and performance of the passive solar Mount Airy Public Labrary are described. Both the owner's and designers's perspectives of the building are presented. Some budgetary information is included. (BCS)

25493 **(DTH-LV—170) Modelling and simulation of solar heating systems.** Moerck, O.C. (Danmarks Tekniske Hoejskole, Lyngby. Lab. for Varmeisolering). Oct 1985. 12p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86751512.

Solar energy utilization will be of a steadily increasing importance for the supply of the worlds energy demand in the future. Of the many applications for which solar energy can be used, the conversion to heating energy for use in buildings seems to be simple and straightforward. However, optimum strategies for the design, construction and operation of solar heating systems are essential to accelerate the use of this technology today, in order to be preapared for the future. Modelling and simulation is one of the research and development acitivities needed to develop optimum strategies for an efficient use of solar energy. The document summarizes a number of different activities undertaken by the author, covering different aspects of modelling and simulation of solar heating systems. The theme of the presentation is the process of model development, validation and use.

25494 **(PB—86-141496/XAB) Understanding solar stills. Technical paper.** Gordes, J.; McCracken, H. (Volunteers in Technical Assistance, Inc., Arlington, VA (USA)). 1985. 53p. (VITA/TP—37:9/85). NTIS, PC A04/MF A01.

exThe report focuses mainly on small-scale basin-type solar stills as suppliers of potable water for families and other small users. Of all the solar-still designs developed thus far, the basin-type continues to be the most economical.

25495 **(PB—86-141512/XAB) Understanding solar cookers. Technical paper.** Bowman, T. (Volunteers in Technical Assistance, Inc., Arlington, VA (USA)). 1985. 34p. (VITA/TP—36:9/85). NTIS, PC A04/MF A01.

Topics include: Potential applications for solar cookers; An historical overview on the development of solar cooking technology; Design, operation, and maintenance characteristics and functions of solar cookers; And points to consider, in regard to solar cooker acquisition, installation, and potential problems.

25496 **(PB—86-142213/XAB) Economic analyses of central solar-heating systems with seasonal storage.** Lund, P.D.; Keinonen, R.S. (Helsinki Univ. of Technology, Otaniemi (Finland). Dept. of Technical Physics). 9 Sep 1985. 36p. (TKK-F-A—589). NTIS, PC A03/MF E01.

Economic optimization of large active community solar-heating systems with annual thermal storage is discussed. The economic evaluation is based on a thermal-performance simulation model employing one-hour-time steps and on detailed updated cost data. Different system configurations and subsystem sizes were considered.

25497 **(SAND—82-8254) Solar central receiver high temperature process air systems.** De Laquil, P. III; Yang, C.L.; Noring, J.E. (Sandia National Labs., Livermore, CA (USA)). Feb 1983. Contract AC04-76DR00789. 65p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE86007780.

The cost-effectiveness of solar central receiver high-temperature industrial process air delivery systems is evaluated. Seven solar air-heating receiver concepts are compared at outlet temperatures of 1000°F (538°C), 1500°F (816°C), and 2000°F (1093°C) and at operating pressures of 1, 5, and 10 atmospheres. A consistent set of receiver cost and performance data, which is derived from a previous study by Pacific Northwest Laboratories, is used in the analysis. Piping and compressor machinery costs are also reported. The

study shows that these air-heating receiver concepts are not particularly attractive technological options for solar central receiver systems. Inherently poor gas heat transfer characteristics make the receivers expensive, and both piping and compressor machinery costs are significant. The study concludes that alternative central receiver systems need to be pursued for the high temperature process air application.

1410 Solar Collectors And Concentrators

REFER ALSO TO CITATION(S) 25778

25498 **(DTH-LV-MEDD—169) Hydrophile Solar Collector - prototype testing.** Andersen, N.B. (Danmarks Tekniske Hoejskole, Lyngby. Lab. for Varmeisolering). Sep 1985. 63p. (In Danish). NTIS (US Sales Only), PC A04/MF A01. File Number DE86751511.

A solar heating system where the heat is transferred from the collector to the storage by evaporation and condensation of a fluid using a principle different from the heat pipe has been investigated. The principle investigated has been proposed by professor Vagn Korsgaard. A specific design of the principle using water as the active fluid, named a hydrophile solar collector, has been tested in the laboratory simulating the solar irradiance by means of an electrically heated foil attached to the front of the absorber surface. The first design built did not satisfy the expectations but alterations of the design have been made which indicate that substantial improvements are possible. These will be tested in a project to follow. The hydrophile solar collector has also been simulated and compared to a common solar domestic hot water system, using a validated computer model. The simulations on the actual designs pointed out a yield of about 70% of the yield of a common design, but also that further improvements can be made.

25499 **(PB—86-143021/XAB) Understanding solar concentrators. Technical paper.** Kaplan, G.M.; Bowman, T.E.; Raiford, M.; Ribot, J. (Volunteers in Technical Assistance, Inc., Arlington, VA (USA)). 1985. 38p. (VITA/TP—30:6/85). NTIS, PC A04/MF A01.

Topics include: solar concentrator applications, operating instructions, design features and functions, and advantages of using solar concentrators.

1420 Heat Storage

REFER ALSO TO CITATION(S) 25486, 25489, 25496

15 GEOTHERMAL ENERGY

1503 Geothermal Exploration And Exploration Technology

REFER ALSO TO CITATION(S) 26379

1506 Environmental Aspects And Waste Disposal

25500 **(EGG—2445) Geothermal injection technology program. Annual progress report, FY-85.** (EG and G Idaho, Inc., Idaho Falls (USA); Utah Univ. Research Inst., Salt Lake City (USA)). Feb 1986. Contract AC07-76ID01570. 48p. NTIS, PC A03/MF A01; GPO Dep. File Number DE86008319.

This report summarizes injection research conducted during FY-1985. The objective was to develop a better understanding of the migration and impact of fluids injected in geothermal reservoirs. Separate abstracts have been prepared for individual project summaries. (ACR)

1509 Geothermal Engineering

REFER ALSO TO CITATION(S) 25860

1510 Direct Energy Utilization

25501 **Geothermal district heating models: A review of compatibility and validity.** Reistad, G.M.; Lawrence, T. (Oregon State Univ., Corvallis, OR). *ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Transactions;* 90: No. 1B, vp(1984). (CONF-840124—).

From American Society of Heating, Refrigerating and Air-Conditioning Engineers meeting; Atlanta, GA, USA (29 Jan 1984).

Several computer programs for estimating the economic potential of geothermal district heating systems are considered. The intent of the several programs is first reviewed. Then, computer program results from each of the models for several specified test evaluation cases are presented and compared. These comparisons reveal that the models indicate the same general trends but in general do not agree closely enough in absolute value of results to instill a feeling of confidence in the correctness of such results by potential users of the models. Finally, comparisons of piping costs used in several of the models are compared to other pipe costs derived from consulting engineers and general literature values.

16 TIDAL AND WAVE POWER

1608 Wave Energy Converters

25502 **(EFN-LET—1985-31) Concerning wave energy utilization through wave induced floating body motions.** Lunde, J.K. (Energiforskningsnaemnden, Stockholm (Sweden)). Jun 1985. 70p. NTIS (US Sales Only), PC A04/MF A01. File Number DE86751529.

In this approximate method the problem, which in itself is three dimensional, is reduced to a two-dimensional problem by dividing the body transversely into a number of strips, considering each one of these as part of an infinite long cylinder floating horizontally in the fluid, and applying the classical linearized potential theory. The strip theory, which by its nature ignores the interference effects between the different transverse strips, has met with considerably success in predicting responces in heavy and pitch modes. Experience has shown that for more lightly damped motions, such as roll, considerable discrepancies can occur between predicted and measured responses, particularly near resonance. These discrepancies are generally believed to be due to viscous effects, largely associated with vortex shedding from the chines, bilge-keels, bar/box keel, rudder and other appendages and unaccounted for by a rational potential theory if not by empirical corrections. The present work reports on a purely theoretical approach by which the forces arising out of shedding of vortices from certain point on the body may be calculated. The method involves matching an inner solution of the flow in the immediate vicinity of the bilges with an outer solution of the fluid flow associated with the body motion and the free surface. In the inner solution use is made of the fairly new discrete vortec technique, and the outer solution is obtained by conventional strip theory. The technique is used for carrying out parametric study of a body of simple form in roll motion with the centre of roll and the beam/draught ration varied systematically. The result indicates that the damping of this body at resonance is largely accounted for by the effects of vortex shedding from its bilges. 37 refs.

25503 **(NP—6751559) TAPCHAN Wave Power Plants.** (Norwave A/S, Oslo (Norway)). Oct 1983. 12p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86751559.

The Tapered Channel Wave Power Plant (TAPCHAN) is based on a new method for wave energy conversion. The principle of operation can be explained by dividing the system into the following four sub-systems: Firstly, a collector which is designed to concentrate the water energy and optimize collection efficiency for a range of frequencies and directions. Secondly, the energy converter, in which the energy of the collected waves is transformed

into potential energy in an on-shore water reservoir. This is the unique part of the power plant. It consists of a gradually narrowing channel with wall heights equal to the filling level of the reservoir (typical heights 3-7 m). The waves enter the wide end of the channel and as they propagate down the narrowing channel, the wave height is amplified until the wavecrests spill over the walls. Thirdly, a reservoir which provides a stable water supply for the turbines. Finally, the hydroelectric power plant, where well established techniques are used for the generation of electric power. The water turbine driving the electric generator is of a low head type, such as a Kaplan or a tubular turbine. It must be designed for salt water operation and should have good regulation capabilities. Power plants based on the principle described, are now offered on a commercial basis.

25504 (NP—6751560) **Kvaerner Brug's Multiresonant Oscillating Water Column (MOWC). Building of wave energy power stations in Norway.** Boenke, K.; Ambli, N. (Kvaerner Brug A/S, Oslo (Norway)). Nov 1985. 22p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86751560.

Two different prototypes of wave energy converters are presently built in Norway. The two prototypes are quite different in design but have the common feature of being mechanically simple and rugged. In this report the multiresonant oscillating water column (MOWC) of Kvaerner Brug A/S is described. A "water piston", driven by the incoming wave, pumps air back and forth through a symmetrical turbine. The converter has two protruding walls in front of the column's opening, which form a "harbor". This harbor forms a quarter-wave resonator and makes it possible to select dimensions so that this device has two resonance frequencies, one for the column and one for the harbor. Wave energy absorbers working at resonance will absorb energy from a crestlength longer than the absorber lengtrh (along the crest). The air turbine used in the prototype rotates in the same direction irrespective of the air flow direction. The turbine is designed to have a maximum instant capacity of 1000 kW or a maximum average capacity over a wave period of 500 kW. Power prices are expected to be competitive particulary in regions which today depend on diesel generation but have wave energy available. 42 references.

17 WIND ENERGY

25505 (Juel-Spez—328, pp 91-103) **Development aid and traditional use of wind power.** Schiel, T. (Bielefeld Univ., Germany, F.R. Fakultaet fuer Soziologie). Aug 1985. (In German). NTIS (US Sales Only), PC A11/MF A01. File Number DE86751624. (CONF-8505259—).

From Seminar on the use of small-scale wind energy plants in developing countries; Goeppingen, F.R. Germany (14 May 1985).

After some introductory remarks concerning the content and significance of appropriate technologies, some case examples for the use of wind energy are given. The first three examples concern the utilisation of wind power as a free means of air conditioning for indoor living areas. The examples are intended as proof of the fact that modern technology as a substitute has to be thoroughly examined beforehand. A further example is used to show that symbioses between traditional and modern ways of using energy are possible. Conclusions for a development-politically viable use of wind power are drawn at the end; among them the fact that any technology introduced in the near future must be based on the application and further development of already available knowledge, so that in the long term the broadly-based foundations may be laid for the introduction of high-tech as well. (BR).

1701 Availability (climatology)

25506 (Juel-Spez—328, pp 55-63) **Brief outline of wind conditions in developing countries.** Wagner, V. (Deutscher Wetterdienst - Seewetteramt, Hamburg, Germany, F.R.). Aug 1985. (In German). NTIS (US Sales Only), PC A11/MF A01. File Number DE86751624. (CONF-8505259—).

From Seminar on the use of small-scale wind energy plants in developing countries; Goeppingen, F.R. Germany (14 May 1985).

In considering wind conditions in developing countries, the general circulation in those regions (i.e. mainly the tropics and subtropical areas) is pointed out by way of an introduction, with a description of the so-called Hadley circulation. The Hadley circulation, however, becomes more complicated when land masses have to be taken into account. It is difficult to give a general answer to the question of quantitative wind conditions. For developing countries in the small latitudes, a low energy yield will have to be generally assumed. The quantitative details in individual cases will depend on the actual wind distribution in each case. Statistics from series of measurements produced relatively low figures for the energy yield. Suggestions with regard to design and construction and concerning the siting are put forward in conclusion as to how energy exploitation can be increased by wind power plants in developing countries. (BR).

25507 (Juel-Spez—328, pp 153-161) **Wind speed forecast for the site assessment for isolated small-scale wind power stations.** Beckedahl, U.; Reich, G. (Technische Univ. Berlin, Germany, F.R. Interdisziplinaere Projektgruppe fuer Angepasste Technologie). Aug 1985. (In German). NTIS (US Sales Only), PC A11/MF A01. File Number DE86751624. (CONF-8505259—).

From Seminar on the use of small-scale wind energy plants in developing countries; Goeppingen, F.R. Germany (14 May 1985).

A forecast of wind speeds based on measurements from only one year is not generally sufficient for an adequate assessment of the energy output of a wind power installation on a specific site. Especially when dealing with plants running in isolation, longer periods are necessary for the measurements. In the following paper, a wind speed forecast is put forward which integrates the data collected over a number of years from a reference station (e.g. meteorological station) into the data measured in the short term at the actual power station site by means of a correlation calculation. The results obtained as a result of the application of this procedure are presented in the form of measurements taken in Mozambique using the month of February as an example. (orig.).

1703 Regulations

REFER ALSO TO CITATION(S) 25522

1704 Economics

25508 (Juel-Spez—328, pp 217-219) **Export opportunities for German wind engineering to developing countries.** Obermair, G.M.; Jarass, L. (Regensburg Univ., Germany, F.R. Inst. fuer Physik 1 - Theoretische Physik). Aug 1985. (In German). NTIS (US Sales Only), PC A11/MF A01. File Number DE86751624. (CONF-8505259—).

From Seminar on the use of small-scale wind energy plants in developing countries; Goeppingen, F.R. Germany (14 May 1985).

The precondition for the export of German wind technology is the availability of competitive, technically mature and tested systems. In spite of state promotion, these conditions have not been met in the Federal Republic of Germany. Moreover, energy supplies in many developing countries are state subsidised, which results in a reduction of economic efficiency. Before wind engineering can be introduced on a broad scale, long-term programmes for research, development and technology transfer will have to be worked out and secured by means of contracts with the appropriate governments. (BR).

25509 (NVE-E-PUB—1/85) **Small wind power plants on the Norwegian coast. A preliminary study.** (Norges Vassdrags- og Elektrisitetsvesen, Oslo. Energidirektoratet). Jun 1985. 55p. (In Norwegian). NTIS (US Sales Only), PC A04/MF A01. File Number DE86751552.

During 1984-85 a preliminary study was performed to examine the possibility of building small wind power plants on islands and other isolated communities along the Norwegian coast, where the the supply of electric power is particularly expensive. Two dif-

ferent places have been analyzed in detail. One is the island community Givaer, off the coast of Northern Norway, not far from the town of Bodoe. Today its supply system is totally based on diesel units. The other is the small island Gjaesingen, near the Froeya island, west of Trondheim. Its electricity supply is based on cable transmission from the mainland. In the report, short technical descriptions and evaluations of 7 wind machines in the interesting range of ca. 50-60 kW are given. As a main conclusion of the study, it is proposed that after a possibly successful testing of a wind machine in the hard wind and climate conditions of Froeya, a combined wind/diesel system should be developed. 16 references.

1706 Wind Energy Engineering

25510 (DTH-ABK-R—200) **Dimensioning of adhesively bonded joints. A bibliography.** Stang, H. (Krarup (N.), Copenhagen (Denmark)). 1985. 45p. (In Danish). Krarup (N.), Copenhagen (Denmark).

EFP. 30 refs.

Based on a literary study of 30 references this report gives a survey of the methods presently available for the calculation of adhesively bonded joints. Continuum mechanical as well as fracture mechanical techniques are treated. Furthermore the most important practical aspects such as choosing adhesive and surface treatment of the adherends are discussed.

25511 (Juel-Spez—328) **Use of small-scale wind energy plants in developing countries.** (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Projektleitung Energieforschung). Aug 1985. 230p. (In German). (CONF-8505259—). NTIS (US Sales Only), PC A11/MF A01. File Number DE86751624.

From Seminar on the use of small-scale wind energy plants in developing countries; Goeppingen, F.R. Germany (14 May 1985).

The seminar on 'The Use of small-scale wind energy plants in developing countries', which was held in Goeppingen on May 14th and 15th 1985, was the framework in which the following subjects and talks were dealt with: Energy supplies in developing countries, problems and difficulties with co-operation in developing countries, wind conditions in developing countries, ways of using wind power plants to drive water pumps, development projects for decentralised wind power supplies in developing countries, demands placed on electrical equipment and regulation of wind power plant in island operation, export opportunities for German wind power technology in developing countries and a concept for energy supply in small-scale local grids using wind power as the main source of energy. For each of the 15 papers, a separate summary of contents has been made. (BR).

25512 (Juel-Spez—328, pp 3-53) **Design criteria and application of wind energy converters.** Molly, J.P. (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt e.V., Stuttgart, Germany, F.R.). Aug 1985. NTIS (US Sales Only), PC A11/MF A01. File Number DE86751624. (CONF-8505259—).

From Seminar on the use of small-scale wind energy plants in developing countries; Goeppingen, F.R. Germany (14 May 1985).

Some of the most important wind characteristics are explained, including the effects of boundary layer, obstacles and hills. In a short explanation the typical types of wind energy converters are presented, as well as the influence and the effects of the rotor blade number, the specific power installation, rotor speed, type of rotor hub, etc. A method is demonstrated showing how to place the specific rated power for generating energy at minimum cost dependent on the wind velocity frequency curve of the site. An example shows which load cases have to take into account to calculate the operational forces of a wind energy converter. The typical behaviour of the energy output of wind energy converters as well as the behaviour of wind energy converter-storage systems are explained. (orig.).

25513 (Juel-Spez—328, pp 105-118) **Present level of development and ideas on further development for wind/diesel systems in the Federal Republic of Germany and foreign countries.** Fritzsche, A. (Dornier System G.m.b.H., Friedrichshafen, Germany, F.R.). Aug 1985. (In German). NTIS (US Sales Only), PC A11/MF A01. File Number DE86751624. (CONF-8505259—).

From Seminar on the use of small-scale wind energy plants in developing countries; Goeppingen, F.R. Germany (14 May 1985).

Various projects for a hybrid energy supply by means of wind/diesel plants aim at reducing the fuel costs for the diesel electric machinery and making wind-powered energy equipment more reliable. One focal point of discussion both at home and abroad is the regulation of sub-systems for monovalent and bivalent operation modes. The second part of the article gas into the present price situation as far as wind-power turbines and diesel components are concerned, and also the connections between wind cover proportion, consumer profile, consumer adjustment and economic efficiency. These aspects are of decisive importance for the future significance of wind/diesel power stations in the energy economy. (orig.).

25514 (Juel-Spez—328, pp 119-138) **Wind-power operated desalination plant on Suederoog Hallig.** Petersen, G.; Fries, S. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude, Germany, F.R.). Aug 1985. (In German). NTIS (US Sales Only), PC A11/MF A01. File Number DE86751624. (CONF-8505259—).

From Seminar on the use of small-scale wind energy plants in developing countries; Goeppingen, F.R. Germany (14 May 1985).

The concept of 'reverse osmosis' is a pressure filtration process through semi-permeable membranes without the use of thermal energy. This process is being developed in direct competition with evaporator engineering for sea water desalination plants. A desalination plant of this type is in operation on Suederoog Hallig. The energy for this is supplied by a wind-powered MAN Aeroman installation. The dimensioning criteria for the plant as determined by the specific location are described. This is followed by a description of the individual components of the system and the results achieved with it to date. Finally, the report goes into the costs and economic efficiency of the desalination plant. (BR).

25515 (Juel-Spez—328, pp 139-152) **Driving water pumps by means of high-speed wind power stations.** Amann, T. (Maschinenfabrik Augsburg-Nuernberg, M.A.N. A.G., Muenchen, Germany, F.R.). Aug 1985. (In German). NTIS (US Sales Only), PC A11/MF A01. File Number DE86751624. (CONF-8505259—).

From Seminar on the use of small-scale wind energy plants in developing countries; Goeppingen, F.R. Germany (14 May 1985).

Using small-scale wind power plants to drive water pumps is a classic field of application. Plants of this construction type, have again become interesting with a view to some cases for present-day application. The newly developed high-speed wind power plants have made it possible to comply with much more extensive requirements, however. The basic concept of water pumps, the output regulation of the pumps, the pump design (centrifugal or piston pump) and the power transmission between the wind power machinery and the pump are described. A system for extracting water from a deep well is described as an example. The wind-powered pump system in this example is based on the AEROMAN wind power plant for island operation. The criteria that have to be taken into account for the achievement of the best possible water output are listed. (BR).

25516 (Juel-Spez—328, pp 163-170) **Operational experience with a wind pump system with a synchronising generator and electrically driven centrifugal pump.** Bade, B. (Technische Univ. Berlin, Germany, F.R. Interdisziplinaere Projektgruppe fuer Angepasste Technologie). Aug 1985. (In German). NTIS (US Sales Only), PC A11/MF A01. File Number DE86751624. (CONF-8505259—).

From Seminar on the use of small-scale wind energy plants in developing countries; Goeppingen, F.R. Germany (14 May 1985).

Under an inter-disciplinary research project on wind pump systems for Third World countries carried out at the Technical University of Berlin, theoretical and practical studies were made to find out to what extent a wind powered generator can drive an electric pump directly without the use of electric regulating devices. Based on theoretical preliminary work, a small-scale wind pump system was devised for field experiments with output dimensioned at 2 kW. A Bruemmer installation, type BW 51, with a 3.5 kW generator was selected as the wind-power system. It is recorded in conclusion that the basic design concept of this wind pumping system, consisting of a wind-driven wind power station with rotor speed limitation by means of centrifugal regulation, a synchronising generator, a directly controlled asynchronous motor for the pump drive and a standard centrifugal pump, is a system suitable for use in Third World countries. (BR).

25517 (Juel-Spez—328, pp 171-177) **Windmill with sails with a centrifugal pump for drainage purposes in Mahotas, Mozambique.** Twele, J. (Technische Univ. Berlin, Germany, F.R. Interdisziplinaere Projektgruppe fuer Angepasste Technologie). Aug 1985. (In German). NTIS (US Sales Only), PC A11/MF A01. File Number DE86751624. (CONF-8505259—).

From Seminar on the use of small-scale wind energy plants in developing countries; Goeppingen, F.R. Germany (14 May 1985).

Under the research project 'Wind pump systems for irrigation and drainage in developing countries' carried out at the Technical University of Berlin, a windmill with sails for field drainage by means of a wind pumping system was developed for Mozambique and put into experimental use. The field trials were aimed at preparing for a wider use of wind pumping systems as a type of appropriate development technology at the same time. The report describes the installation used for the field trials. (BR).

25518 (Juel-Spez—328, pp 179-189) **Wind energy plants for generating electric power in developing countries.** Wurz, D.; Kniehl, R.; Kunzmann, K. (Karlsruhe Univ., T.H., Germany, F.R. Inst. fuer Technische Thermodynamik). Aug 1985. (In German). NTIS (US Sales Only), PC A11/MF A01. File Number DE86751624. (CONF-8505259—).

From Seminar on the use of small-scale wind energy plants in developing countries; Goeppingen, F.R. Germany (14 May 1985).

Work is being done at Karlsruhe University as a result of a research project run by the Ministry of Research and Technology (BMFT), on a simple wind power plant suitable for developing countries. The plant is expected to cover a wide range of applications for decentralised energy supplies with its nominal electricity output of 5.5 kW - driving electric water pumps will be a focal point. Rotor development has led to highly efficient systems that can be manufactured easily (csub(p) up to 0.40). Fixing the performance data of the rotor and the matching of the components is done by means of a mobile test system whereby the wind turbine is mounted on a lorry. A prototype with a well simulation plant will be in operation from about mid-May 1985 at the DFVLR testing ground in Schnittlingen. (orig.).

25519 (Juel-Spez—328, pp 191-208) **Demands placed on the electrical equipment and the regulation of autonomous wind power stations.** Cramer, G. (SMA System-, Mess- und Anlagentechnik - Regelsysteme G.m.b.H., Niestetal, Germany, F.R.). Aug 1985. (In German). NTIS (US Sales Only), PC A11/MF A01. File Number DE86751624. (CONF-8505259—).

From Seminar on the use of small-scale wind energy plants in developing countries; Goeppingen, F.R. Germany (14 May 1985).

This essay is a description of the electrical equipment and the technical regulation devices required for wind power stations not connected to the public supply network. Individual plants, wind parks and the structure of autonomous supply systems (wind power stations, battery storage and diesel motors) ranging in output from a few kW to several hundred were considered. In addition to the varying consumer requirements, the aspects of supply safety were taken into special account with regard to the listed designs. (orig./BWI).

25520 (Juel-Spez—328, pp 209-216) **Energy supply concept for individual consumers and small local grids using wind as the main energy source.** Koehne, W. (Suedwind Windkraftanlagen, Berlin, Germany, F.R.). Aug 1985. (In German). NTIS (US Sales Only), PC A11/MF A01. File Number DE86751624. (CONF-8505259—).

From Seminar on the use of small-scale wind energy plants in developing countries; Goeppingen, F.R. Germany (14 May 1985).

In developing countries, the decentralised use of renewable energy sources is particularly attractive, not only for reasons of cost but also for improving consistent supplies. In order to ensure the most complete supply possible for individual consumers or small local grids needing electricity and heat, a system is proposed consisting of: wind power plant with electronic generator load regulation and flapping hinges, battery storage, heat storage, input point for solar energy, diesel or gas driven auxiliary generator and control of the consuming devices and the auxiliary generator according to wind availability on the basis of pre-determined priorities. The present state of development of the proposed system is demonstrated. (BR).

25521 (NP—6751622) **Safety and service life of wind power plants.** Vogt, H. (Ministerium fuer Wirtschaft und Verkehr des Landes Schleswig-Holstein, Kiel (Germany, F.R.)). [1986]. 13p. (In German). NTIS (US Sales Only), PC A02/MF A01. File Number DE86751622.

The article concerns the correlations between assumed loads and safety or service life of wind power plants. A great number of issues will have to be considered when establishing assumptions for loads occuring in wind power plants. The particular operating features of wind power plants are mentioned as are their possible hazards. Certain requirements will have to be made on operational reliability/safety for substantiating assumed operational loads. Additional requirements are made on accuracy, evenness and quality in plant component manufacturing. Special attention is given to replacement parts which are vital for safety. The report underlines the fact that a number of load assumption issues for wind power plants have not been cleared up yet. (BR).

25522 (NP—6751628) **Instructions for the constructional supervision of wind power plants.** Vogt, H. (Ministerium fuer Wirtschaft und Verkehr des Landes Schleswig-Holstein, Kiel (Germany, F.R.)). 1984. 68p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE86751628.

The constructional supervision of wind power plants involves the observance of the 'Vorlaeufige Richtlinien fuer die Aufstellung und das Betreiben von Windkraftanlagen', recommended by the Schleswig-Holstein Minister of the Interior. Much of these recommendations, however, is still left to be improved and completed. As they do not contain instructions for installation and inspection, the author has worked out a separate feasible scheme. The study comprises 5 interdependent papers dealing with the tower and foundation of wind power plants, statical calculations and construction of steel towers, safety engineering, wind turbine stability of rotor wind power plants and problems of how to acquire wind power plant construction permits. (BR).

25523 (RISO-M—2451-Pt.2) **Aero- and structural-dynamic investigation on a Darrieus rotor. Pt. 2. Theoretical basis.** Schmidt Paulsen, U.; Noerkaer, J.; Nielsen, J.E. (Risoe National Lab., Roskilde (Denmark)). Jan 1985. 204p. (In Danish). NTIS (US Sales Only), PC A10/MF A01. File Number DE86751514.

The report is concerned with theoretical investigations on aero- and structural-dynamics of a Darrieus rotor. Two aerodynamical models are presented: A model based on linear momentum theory (Multiple Streamtube Double Disc Model) and a vortex model based on quasi unsteady relaxed wake analysis. The structural dynamics of the rotor and the aeroelasticity of the rotor blades are investigated and modelled on the experimental AFM-4 m Dar-

rieus turbine sited at Risoe. Furthermore, aerodynamical measurements are carried out on NACA 0018 profile wing section, due to different Reynolds Numbers. Performance characteristics of the experimental AFM-4 metre Darrieus Wind Turbine are presented.

25524 **(THD-IW-R—508) A review of wind turbine aerodynamics: after 100 years still something to do.** Van Bussel, G.J.W.; Van Kuik, G.A.M.; Kusters, R.M. (Technische Hogeschool Delft (Netherlands); Technische Hogeschool Eindhoven (Netherlands). Afdeling Technische Natuurkunde). Nov 1985. 12p. (In Dutch). (CONF-851274—2; THE-R—758-D). TH, Instituut voor Windenergie, Kluyverweg 1, 2629 HS Delft, Netherlands.

From National wind energy conference; Noordwijkerhout, Netherlands (1 Dec 1985).

A review is presented of research on aerodynamics of wind turbines. The theory of wind turbine blades and helicopter blades is compared. Research done in the Netherlands is summarized briefly. (J.C.R.)

25525 **(THE-R—759-D) An improvement of the axial impulse theory for rotors, and the consequence for the aerodynamics of wind energy.** Van Kuik, G.A.M. (Technische Hogeschool Eindhoven (Netherlands). Afdeling Technische Natuurkunde). Nov 1985. 10p. (In Dutch). (CONF-851274—1). TH, Vakgroep Transportfysica, P.O. Box 513, 5600 MB Eindhoven, Netherlands.

From National wind energy conference; Noordwijkerhout, Netherlands (1 Dec 1985).

The classical axial momentum theory for wind turbines is critically considered and improved. The homogeneous load on the 'porous disk', i.e. the diameter of the rotor is found not to be homogeneous, but forces at the edge of this disk cause significant deviations. Consequences are: less power is generated than calculated and Lanchester-Betz maximum is not an absolute maximum. This edge-effect is not fully understood and calculated yet, nor is it incorporated in any existing model. Further investigations are made at Eindhoven with a helicopter rotor. (A.V.)

25526 **(VTT-TIED—282) Wind energy in electric power production. Preliminary study.** Lento, R.; Peltola, E. (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)). Jan 1984. 134p. (In Finnish). NTIS (US Sales Only), PC A07/MF A01. File Number DE86751566.

The wind speed conditions in Finland have been studied with the aid of the existing statistics of the Finnish Meteorological Institute. With the aid of the statistics also estimates on the available wind energy were made. 800 wind power plants, 1.5 MW each, on the windiest west coast would produce about 2 TWh energy per year. Far more information on the temporal, geographical and vertical distribution of the wind speed than the present statistics include is needed when the available wind energy is estimated, when wind power plants are dimensioned optimally, and when suitable locations are chosen for them. The investment costs of a wind power plant increase when the height of the tower or the diameter of the rotor is increased, but the energy production increases, too. Thus, overdimensioning the wind power plant in view of energy needs or the wind conditions causes extra costs. The cost of energy produced by wind power can not yet compete with conventional energy, but the situation changes to the advantage of wind energy, if the real price of the plants decreases (among other things due to large series production and increasing experience), or if the real price of fuels rises. The inconvinience on the environment caused by the wind power plants is considered insignificant. The noise caused by the plant attenuates rapidly with distance. No harmful effects birds and other animals caused by the wind power plants have been observed in the studies made abroad. Parts of a plant getting loose during an accident, or ice forming on the blades are estimated to fly even from a large plant only a few hundred meters.

20 ELECTRIC POWER ENGINEERING

2001 Power Plants And Power Generation

REFER ALSO TO CITATION(S) 25563

25527 **(DOE/MC/20324—2033) Gas turbine systems. Research and Development Program. Final report.** Horazak, D.A.; DeLallo, M.R.; Klett, M.G.; Im, C.J.; Wright, R.E. (Westinghouse Electric Corp., Concordville, PA (USA). Combustion Turbine Systems Div.). Feb 1986. Contract AC21-83MC20324. 359p. NTIS, PC A16/MF A01; 1; GPO Dep. File Number DE86007171.

Previously reported screening studies showed the economic benefit of a slurry-fueled combined cycle with fuel preparation at the power plant site, and form the basis for this investigation of beneficiation and slurry production. This report evaluates alternate methods of processing utility grade coal into an acceptable gas turbine fuel. The study is a comparison of four types fuel processing facilities: physical beneficiation and slurry manufacture at the power plant, beneficiation at the mine with slurry production at the power plant, increased slurry fuel storage, and selective chemical beneficiation. Evaluation is based on the criterion of coal-to-busbar cost of electricity (COE). The recommended power plant configuration is a gas turbine combined cycle fueled by coal-water slurry, which is prepared at the power plant. The on-site fuel preparation consists of conventional grinding and slurry production. The COE of a mature plant is $81/MWh, 22% less than the $103.2/MWh of a pulverized coal power plant with flue gas desulfurization. Sulfur and particulate matter are removed from the coal either by a slagging combustor or by cleanup devices, eliminating the need for beneficiation and fine grinding mills in the fuel processing facility. This configuration includes more development while benefitting from reduced capital and operating costs. The study also includes a survey of current chemical coal cleaning technology, an evaluation of the sensitivity of COE to capacity factor, and recommendations for research and development. 36 figs., 112 tabs.

25528 **(EPRI-AP—4475) Combustion turbine materials problems. Final report.** Cialone, H.J.; Landow, M.P.; Wright, I.G.; Jackson, C.M. (Battelle Columbus Labs., OH (USA)). Mar 1986. 101p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI86920230.

Interviews with utility users, manufacturers, and repair and maintenance companies have helped researchers identify the most-pressing materials problems in combustion turbines. The project team used this information to establish R & D priorities for turbine materials.

25529 **(EPRI-AP—4476) Materials for large land-based gas turbines. Final report.** (National Materials Advisory Board (NRC), Washington, DC (USA)). Mar 1986. 114p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI86920228.

Advanced large land-based gas turbines are expected to be a key component in the future generation of electric power based on coal gasification and a combined-cycle gas turbine-steam turbine system. The proposed fuel for such turbines is a medium-Btu, very clean gas produced by an advanced coal gasification process. With the successful demonstration of this combined-cycle process, EPRI commissioned this assessment of the technology for developing higher power, higher performance gas turbines for potential use as base-load power generation units. The development of gas turbines in the 120- to 150-MW range with turbine inlet temperatures to 2600°F at pressure ratios up to 16:1 over the next 15 to 20 years is envisioned. Currently available and developing materials technology useful for large machines is reviewed and discussed. Although the primary source of these developments is the aircraft engine field, other sources are also reviewed. Suitable technology appears to be available as a foundation for the developments necessary to extrapolate to higher power, long-life turbines for utility power generation. Recommendations are made for specific research and development efforts that address the special requirements and environment of these machines. 104 refs., 57 figs., 8 tabs.

25530 (STEV-NYEL—85-3) Specifications of small thermal power plants combined with gas-generator engines. Kjellstroem, B. (Statens Energiverk, Stockholm (Sweden)). Jun 1985. 46p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. File Number DE86751548.

The purpose of the specifications given in the report is to define the future development of small thermal power plants combined with gas-generation engines. The plants, in the size 50 kW to 5 MW, should be key-ready and prepared to connect with the power rid and supply heat to heat distribution systems. The specifications can be fulfilled by different technical solutions and choice of fuel.

25531 (STF—15A85030) Problems with wood-fired boiler systems. Rosvold, H. (SINTEF, Trondheim (Norway)). Jun 1985. 79p. (In Norwegian). NTIS (US Sales Only), PC A05/MF A01. File Number DE86751557.

Service-related problems in connection with wood-fired boiler systems together with causal relations are discussed. Specifications of the increasing number of chimney-fires in connection with log-fired systems in Norway are given. Practical experiences show an increasing pitchy deposition in chimneys together with smoke emission in boiler rooms. Many steam explosions have happened, and improvements of the service such as training together with better check routines and standard approval certificates are needed. Combustion measurements show that no boiler systems are burning efficiently in all cases, and new types of boilers must be developed. 14 drawings, 3 tables.

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REFER ALSO TO CITATION(S) 25300, 25321, 26158

25532 (DOE/ET/10593—T3) Fundamentals of nitric oxide formation in fossil fuel combustion. Final report, June 1975-June 1981. Houser, T.; McCarville, M.E. (Western Michigan Univ., Kalamazoo (USA). Dept. of Chemistry). Mar 1986. Contract AC21-75ET10593. 68p. (FE—2018-21). NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE86007468.

The rates of and products from the pyrolysis of pyridine and from oxidations of pyridine, cyanogen and HCN were determined using an atmospheric pressure flow system equipped with a Vycor, stirred-flow reactor to obtain differential rate data. On-stream mass spectrometric and gas chromatographic monitoring of the concentrations of products and reactants as well as chemiluminescent (for nitrogen oxides) and specific ion electrode (for cyanide and ammonia) measurements were used to obtain the data. Rate equations were determined for the pyrolysis of pyridine in the range of 875 to 1050°C and for the oxidations of pyridine (675 to 775°C), HCN (750 to 825°C) and cyanogen (950 to 1000°C). The products from the oxidations were determined over somewhat larger temperature ranges. At the dilute concentrations used in this study NO/sub x/ was produced only with lean mixture ratios and at the relatively higher temperatures and/or concentrations. The transition from negligible amounts of NO/sub x/ produced at the lower temperatures and/or concentrations to the formation of significant NO/sub x/ yields appears to be sudden rather than gradual, indicating a rapid shift in mechanism requiring threshold conditions to be initiated. 44 refs., 21 tabs.

25533 (DOE/FE/60181—170) Flue gas conditioning for improved baghouse performance. Laudal, D.L.; Miller, S.J. (North Dakota Univ., Grand Forks (USA). Energy Research Center). Feb 1986. Contract FC21-83FE60181. 19p. (CONF-860213—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86008813.

From 6. symposium on the transfer and utilization of particulate control technology; New Orleans, LA, USA (25 Feb 1986).

Baghouse performance has been shown to be dependent on both the chemical and physical properties of the ash. Small amounts of ammonia and sulfur trioxide were added to the flue gas as conditioning agents to modify ash characteristics and reduce fine particulate emissions from a pilot-scale coal combustion/baghouse system. Tests were made with three western low-rank coals which produce difficult to collect fly ash. Total particulate emissions over several cleaning cycles were substantially reduced and fine particulate emissions were reduced up to four orders of magnitude between the cycles. With conditioning baghouse pressure drop increased at a slower rate and reached a lower operating pressure drop after several cleaning cycles. Ash samples were analyzed to determine physical and chemical changes due to ammonia and sulfur trioxide addition. Several ammonia-sulfur compounds were found indicating a complex chemical mechanism. Changes in the fly ash particle size distribution and bulk ash cohesiveness may help explain the physical mechanism by which both pressure drop and particulate emissions are reduced. 14 refs., 7 figs., 4 tab.s

25534 (DOE/NBM—6007218) Proposed BPA Region-wide Weatherization Program. Revised environmental assessment. (Bonneville Power Administration, Portland, OR (USA)). Sep 1981. 121p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE86007218.

BPA proposes a 10-year program to encourage the weatherization of electrically-heated homes in the Pacific Northwest. Utilities may choose between two financial incentives: no-interest loans to finance weatherization within a BPA program package, or rebates to utilities for energy saved through utility designed and administered programs. This weatherization program may result in the degradation of indoor air quality and result in hazards to human health due to measures which reduce air infiltration in residence. As infiltration into residences is reduced, pollutants given off by building components, contents, and household activities accumulate in the air inside. Conversely, indoor concentrations of pollutants generated outside are reduced. Potentially hazardous indoor air pollutants include: radon and radon decay products, formaldehyde, particulates (including asbestos), nitrogen oxides, carbon monoxide, hydrocarbons (especially benzo(a)pyrene), pesticides, organic chemicals, bacteria, and viruses. Research is underway at BPA and in numerous other locations to obtain measurements of pollutant concentrations and infiltration rates, to test the effectiveness of mitigation measures, and to better define the relationships between air infiltration, pollutant concentrations, and human health. With the exception of the indoor air quality impacts on human health, all of the potential adverse impacts of the program are minor. Five alternatives are considered in this Environmental Assessment.

25535 (FES—83-23) Eugene-Medford 500 kV transmission line. Final Environmental Impact Statement. (Envirosphere Co., Bellevue, WA (USA)). May 1983. 365p. NTIS, PC A16/MF A01; 1; GPO Dep. File Number DE86008552.

This Final Environmental Impact Statement (FEIS) describes and analyzes the environmental impacts of a proposed 500 kV transmission line from Eugene to Medford, Oregon. The project is being proposed by Pacific Power and Light Company (Pacific) to reliably serve anticipated electric loads in Pacific's southern Oregon and northern California service area. An additional project purpose identified by the Bonneville Power Administration (BPA) is to satisfy a future requirement to upgrade service in the Eugene area.

25536 (IFE/KR/E—85/005) Radiological consequences of atmospheric releases from coal-fired power plants. A critical survey of calculations reported in literature. Tveten, U. (Institute for Energy Technology, Kjeller (Norway)). Jun 1985. 55p. NTIS (US Sales Only), PC A04/MF A01. File Number DE86701386.

The report deals with the individual and collective doses resulting from radioactive materials contained in the stack releases of coal-fired power plants. A critical analysis of relevant calculations in literature is given. The different reports analyzed show a very wide range in calculated doses. To a great extent these differences may be explained by the wide range in the assumptions adopted. There is also disagreement on what exposure pathways are the most important, and what nuclides contribute most to calculated doses. A most probable value of 0.5 mrem/year for the maximum individual effective dose equivalent commitment, is indicated in the report. 57 refs.

25537 (KFK-PEF—2, pp 597-611) **Development of economic-technological strategies concerning emission reduction measures for sulphur dioxide and nitrogen oxides emitted by stationary production plants in Baden-Wuerttemberg.** Rentz, O.; Haasis, H.D.; Sautter, T. (Karlsruhe Univ., T.H., Germany, F.R. Inst. fuer Industriebetriebslehre und Industrielle Produktion). Apr 1985. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86751479. (CONF-8503225—).

From 1. status colloquium of the European Research Center project for air pollution abatement measures (PEF) of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (5 Mar 1985).

By now, flue gas desulphurization and denitrification plants are either planned or under construction or partly in operation in public utility power plants in Baden Wuerttemberg. Extended emission reduction measures are planned for the refineries of ESSO AG and Oberrheinische Mineraloelwerke GmbH. Consequently, this results in a shift in the emission distribution pattern of sulphur dioxide and nitrogen oxides, i.e. the percentage of energy conversion plants in total SO_2 emissions (total NOsub(x) emissions) is reduced from approx. 35% (22%) to approx. 15% (12%), whereas the emission percentage of industrial plants is raised from approx. 40% (10%) to approx. 55% (13%). The greatest reduction potential concerning industrial firing installations will be in the sector of 'Base material and production goods industries'. Depending on the limit value to be observed, emission reduction measurements will comprise fuel substitution as well as primary and secondary measures. Several processes concerning secondary measures are available on the market for small-scale firing installations by now. Statements on possible shifts in energy supply structure will not be feasible until after completion of optimization test runs. This requires a demonstration of the production system of Baden Wuerttemberg which can be done in the model. Model modifications required will be finished in the near future.

25538 (PB—86-131430/XAB) **Project summary utility FGD (flue-gas desulfurization) survey, October 1983-September 1984. Final report.** Melia, M.T.; McKibben, R.S.; Pelsor, B.W. (PEDCo-Environmental, Inc., Cincinnati, OH (USA)). Oct 1984. 33p. NTIS, PC A03/MF A01.

The report, which is generated by a computerized data base system, represents a survey of operational and planned domestic utility flue-gas desulfurization (FGD) systems. It summarizes information contributed by the utility industry, system and equipment suppliers, system designers, research organizations, and regulatory agencies. The data cover system design, fuel characteristics, history of utility FGD operating status nationwide, and capital and annual costs for operating FGD systems. The development status (operational, under construction, or in the planning stages), system supplier, and process are tabulated alphabetically by utility company. Also included are highlights of FGD system developments during the period of October 1983 through September 1984. Current data for domestic FGD systems show 124 systems in operation, 25 systems under construction, and 68 systems planned. The current FGD-controlled capacity in the United States is 47,255 MW.

25539 (PB—86-147618/XAB) **Utility FGD (flue gas desulfurization) survey: October 1983-September 1984. Volume 2. Design performance data for operating FGD systems (part 1). Final report.** Melia, M.T.; McKibben, R.S.; Pelsor, B.W. (PEDCo-Environmental, Inc., Cincinnati, OH (USA)). Oct 1984. 715p. NTIS, PC A$52.95/MF $52.95.

The report, which is generated by a computerized data base system, represents a survey of operational and planned domestic utility flue-gas desulfurization (FGD) system. The three volume set summarizes information contributed by the utility industry, system and equipment suppliers, system designers, research organizations, and regulatory agencies. The data cover system design, fuel characteristics, operating history, and actual system performance. Also included is a unit-by-unit discussion of problems and solutions associated with the boilers, scrubbers, and FGD systems. The development status (operational, under construction, or in the planning stages), system supplier, process, waste disposal practice, and regulatory class are tabulated alphabetically by utility company. Simplified process flow diagrams of FGD systems, definitions, and a glossary of terms are attached to the report. Current data for domestic FGD systems show 124 systems in operation, 25 systems under construction, and 68 systems planned. The current FGD-controlled capacity in the United States is 47,255 MW.

25540 (PB—86-147626/XAB) **Utility FGD (flue gas desulfurization) survey: October 1983-September 1984. Volume 2. Design performance data for operating FGD systems (Part 2). Final report.** Melia, M.T.; McKibben, R.S.; Pelsor, B.W. (PEDCo-Environmental, Inc., Cincinnati, OH (USA)). Oct 1984. 618p. NTIS, PC A99/MF A01.

The report, which is generated by a computerized data base system, represents a survey of operational and planned domestic utility flue gas desulfurization (FGD) system. The three volume set summarizes information contributed by the utility industry, system and equipment suppliers, system designers, research organizations, and regulatory agencies. The data cover system design, fuel characteristics, operating history, and actual system performance. Also included is a unit-by-unit discussion of problems and solutions associated with the boilers, scrubbers, and FGD systems. The development status (operational, under construction, or in the planning stages), system supplier, process, waste disposal practice, and regulatory class are tabulated alphabetically by utility company. Simplified process flow diagrams of FGD systems, definitions, and a glossary of terms are attached to the report. Current data for domestic FGD systems show 124 systems in operation, 25 systems under construction, and 68 systems planned. The current FGD-controlled capacity in the United States is 47,255 MW.

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25541 (CONF-860564—1) **EMP coupling on overhead cables revisited.** Agouridis, D.C. (Oak Ridge National Lab., TN (USA)). 1986. Contract AC05-84OR21400. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86003858.

From EMP nuclear meeting; Albuquerque, NM, USA (19 May 1986).

A careful examination of the problem of EMP coupling on overhead cables reveals some errors in the results and concepts found in the literature. This paper corrects these errors and redefines the concepts of critical length, height, and angles required for maximum coupling.

25542 (NP—6901116) **Reliability consideration in generation, transmission and distribution of electric power system: with special reference to India .** Natarajan, T.V.; Bhattacharya, A. (Tata Energy Research Inst., New Delhi (India)). [1986]. 30p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86901116.

Two different mathematical methods are used to calculate the reliability indices. The analytical method which makes direct use of the probability axioms and the Monte Carlo method uses the computer to simulate various random events. Out of all these indexes, LOLP is used when generation system planning is carried out and FAD is used for transmission and distribution system planning analysis. The main purpose of the paper is to critically assess different concepts of reliability indices as applied in electric power system.

25543 (ORNL/Sub—81-16957/1) **Cost/risk trade-offs of alternate protection schemes for small power sources connected to an electric distribution system.** Curtice, D.; Bowe, T.R.; Iqbal, S.; Dapkus, W.D.; Rizy, D.T. (Systems Control, Inc., Palo Alto, CA (USA). Energy Systems Div.). Jan 1986. Contract AC05-84OR21400. 94p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE86008952.

The provisions of the Public Utility Regulatory Policies Act of 1978 have stimulated the interconnection of dispersed storage and generation (DSG) devices on utility distribution systems. One of the requirements for parallel operation of DSGs is that adequate protection be provided at the point of interconnection to ensure that DSGs do not damage the utility's distribution system and customers' loads when a utility system abnormality (open or short circuit) occurs. This report describes a methodology formulated to aid in deciding on the appropriate quality and quantity of protection

equipment required for a small electric power producing device, known in the industry as dispersed storage and generation. In this methodology, a discrete state-space model of the response of both the utility's and DSG's protection equipment to shunt faults (short circuits) and series faults (open circuits) on an electric distribution feeder is developed. The parameters of the model are linked to the component reliabilities of the protection schemes and to the specific characteristics of the distribution system. The mathematics of semi-Markov theory are used in the methodology to calculate the expected annual damage costs for various protection schemes. The total costs are calculated for alternative protection schemes by considering equipment damage, repair time, lost revenue, outage costs, and time spent in different operating states during the hazardous condition(s). This methodology is useful to electric utilities, small power producers, and regulatory bodies who must make decisions regarding the adequacy and the cost-effectiveness of protection requirements for DSG installations. The model is implemented on the computer in the form of a FORTRAN program, PROTECT. A sample evaluation among various protection schemes is presented. Four schemes are designed for a 500-kVA synchronous generator connected to a hypothetical feeder.

21 NUCLEAR POWER PLANTS

REFER ALSO TO CITATION(S) 25720

2101 Power Reactors, Non-breeding, Light-water Moderated, Boiling Water Cooled

REFER ALSO TO CITATION(S) 25578, 25579, 25674, 25675, 25684, 25686, 25689, 25691

25544 **(EPRI-NP—4470M) Operation of hydrogen water chemistry for 18-month cycle at Dresden-2.** Sundberg, L.L.; Cowan, R.L.; Huff, J.M.; Skarpelos, J.M.; Law, R.J.; Marble, W.J.; Peterson, J.P.; Nelson, W.B.; Nesbett, L.B.; Head, R.A. (General Electric Co., San Jose, CA (USA). Nuclear Energy Business Operations). Mar 1986. 25p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI86920202.

This document provides an interim report on the progress of Project RP1930-7, BWR Hydrogen Water Chemistry - Chemical Surveillance. It describes the work performed at Commonwealth Edison's Dresden Nuclear Power Station Unit 2 during its first full fuel cycle on Hydrogen Water Chemistry to monitor its chemical and radiological performance. It includes the results of gamma scan/dose rate campaigns, ion chromatography, and other extensive water chemistry measurements. Also reported are findings and recommendations regarding plant operational practices and offgas fires. This experience at Dresden-2 has demonstrated that a plant can operate on Hydrogen Water Chemistry with only minor impact on plant parameters, but with a major positive impact on intergranular stress corrosion cracking (IGSCC) mitigation for sensitized stainless steel components.

25545 **(IAEA-TECDOC—344) Advanced light and heavy water reactors for improved fuel utilization. Proceedings of a technical committee and workshop on advanced light and heavy water reactor technology held in Vienna, 26-29 November 1984.** (International Atomic Energy Agency, Vienna (Austria)). Sep 1985. 202p. (CONF-8411237—). NTIS (US Sales Only), PC A10/MF A01. File Number DE86701630.

From Technical committee and workshop on advanced light and heavy water reactor technology; Vienna, Austria (26 Nov 1984).

On 26-29 November 1984, the Agency convened at its Headquarters in Vienna the Technical Committee and Workshop on Advanced Light and Heavy Water Reactor Technology in order to provide an opportunity to review and discuss the current status and recent development in the layout and design of an advanced water reactor and to identify areas in which additional research and development are needed. The meeting was attended by 45 participants from 16 nations and 2 international organizations presenting 25 papers. The Conference presentations were divided into sessions devoted to the following topics: Advanced light water reactor programmes (6 papers); Advanced light water design, technology and physics (12 papers); Advanced heavy water reactors (7 papers). A separate abstract was prepared for each of these papers.

25546 (IAEA-TECDOC—344, pp 18-21) **Review of concepts to improve uranium utilization in light water reactors, with emphasis on nonbackfittable options.** Lang, P.M. (Department of Energy, Washington, DC, USA). Sep 1985. NTIS (US Sales Only), PC A10/MF A01. File Number DE86701630. (CONF-8411237—).

From Technical committee and workshop on advanced light and heavy water reactor technology; Vienna, Austria (26 Nov 1984).

The paper contains a detailed description of various options that can be implemented into light water reactors in order to improve their uranium utilization. Backfittable options which can readily and economically be implemented into both existing and future plants, have received higher interest than nonbackfittable options, which require changes in the plant design. The paper contains the potential uranium savings of backfittable and nonbackfittable options.

25547 (IAEA-TECDOC—344, pp 56-57) **Advanced high conversion boiling water reactor.** Crowther, R.L.; Matzner, B.; Mott, S.L.; Savoia, P.J.; Schmidt, R.A. (General Electric Co., San Jose, CA, USA). Sep 1985. NTIS (US Sales Only), PC A10/MF A01. File Number DE86701630. (CONF-8411237—).

From Technical committee and workshop on advanced light and heavy water reactor technology; Vienna, Austria (26 Nov 1984).

25548 (IAEA-TECDOC—344, pp 57-62) **New LWR core concept of improved uranium utilization.** Takeda, R.; Yokomi, M. (Hitachi Ltd., Ibaraki, Japan. Energy Research Lab.; Hitachi Ltd., Ibaraki, Japan. Hitachi Works). Sep 1985. NTIS (US Sales Only), PC A10/MF A01. File Number DE86701630. (CONF-8411237—).

From Technical committee and workshop on advanced light and heavy water reactor technology; Vienna, Austria (26 Nov 1984).

The paper contains a description and discussion of measurements for the improvement of fuel utilization in Light Water Reactors. An outline of a possible approach in Japan is presented which aims at the extended burnup and the reduction of fuel cycle costs. The main design parameters of a high conversion and burner type LWR are presented and discussed.

25549 (IAEA-TECDOC—344, pp 91-103) **Advanced uranium utilisation in LWR by recycling of uranium and plutonium.** Beer, O.; Schlosser, G.J. (Kraftwerk Union A.G., Erlangen, Germany, F.R.). Sep 1985. NTIS (US Sales Only), PC A10/MF A01. File Number DE86701630. (CONF-8411237—).

From Technical committee and workshop on advanced light and heavy water reactor technology; Vienna, Austria (26 Nov 1984).

In the long term the optimum utilisation for plutonium will be in fast breeder reactors. However, as long as the plutonium supply from reprocessing plants exceeds the plutonium demand of fast breeder reactors, recycling of plutonium in light water reactors is a convenient interim solution by which a significant advanced uranium utilization is achieved. The demonstration of plutonium recycling performed to date in the Federal Republic of Germany in BWR's and PWR's shows that thermal plutonium recycling on an industrial scale is feasible and that the usual levels of reliability and safety can be achieved in reactor operation. The successful use of mixed oxide fuel assemblies is demonstrated by the large-scale recycling programmes in PWR's of 345, 810 and 1300 MWe. The recycling of reprocessed uranium is presently demonstrated in the Obrigheim nuclear power plant. As regards fuel cycle economy thermal recycling allows savings in natural uranium and separative work not to mention avoidance of plutonium storage costs. Already under present cost conditions the fuel cycle costs for mixed oxide or enriched reprocessed uranium fuel assemblies are equal or even lower than for "usual" uranium fuel assemblies.

25550 (IAEA-TECDOC—344, pp 118-126) **Conceptual design of a fuel bundle for extended burnup in BWRs.** Takeda, R.; Aoyama, M.; Uchikawa, S.; Yokomi, M. (Hitachi Ltd., Ibaraki, Japan. Energy Research Lab.; Hitachi Ltd., Ibaraki, Japan. Hitachi Works). Sep 1985. NTIS (US Sales Only), PC A10/MF A01. File Number DE86701630. (CONF-8411237—).

From Technical committee and workshop on advanced light and heavy water reactor technology; Vienna, Austria (26 Nov 1984).

A new design concept of a BWR fuel bundle for extended burnup was proposed in order to improve the capacity factor without increasing the fuel cycle cost. Some effects which are raised from higher burnup, such as strong pellet-cladding interaction due to enhanced fuel swelling and changes in neutronic characteristics due to increased fuel enrichment, are minimized by a reduction in the maximum fuel temperature to below 1200 deg. C and reduction in heterogeneity of fuel bundle design. To realize these concepts, a 9x9 lattice design with an increased number of water rods and either annular or dual pellets was proposed. The proposed fuel bundle design offers advantages in fuel cycle improvement through extension of achievable burnup and flattening the thermal neutron flux across the fuel bundle. The core, loaded with the proposed fuel bundles which achieve about 30% higher burnup by the full power month, has a potential for natural uranium savings of more than 20% per unit power and a reduction in the amount of reprocessing of about 24% per unit power, compared with the current BWR design when coupled with other improvements such as refueling pattern optimization, natural uranium axial blankets, and spectral shift with flow control.

25551 (IWGFPT—13, pp 39-62) **Release of tellurium and cesium from UO_2 in LWR fuel rods during irradiation.** Malen, K.A. (Studsvik Energiteknik AB, Nykoeping, Sweden). Mar 1983. NTIS (US Sales Only), PC A99/MF A01. File Number DE84900984. (CONF-820360—).

From IAEA specialists meeting on water reactor fuel element performance computer modelling; Preston, UK (15 Mar 1982).

In this paper the release of tellurium (Te-132) and cesium (Cs-134 and Cs-137) from UO_2-fuel is analyzed. The basis for the analysis is the experimental results from the S176 series of experiments performed at Studsvik. It seems that the model developed earlier for release of iodine applies also to tellurium and cesium. This model assumes sweeping up of the species in question by moving grain boundaries and subsequent release through grain boundary porosity. An interesting extra feature is deposition of tellurium at temperatures in the range 1500-2000 K believed to be due to condensation.

25552 (IWGFPT—13, pp 147-161) **Fuel pellet fracture and relocation.** Walton, L.A.; Husser, D.L. (Babcock and Wilcox Co., Lynchburg, VA, USA. Nuclear Power Generation Div.). Mar 1983. NTIS (US Sales Only), PC A99/MF A01. File Number DE84900984. (CONF-820360—).

From IAEA specialists meeting on water reactor fuel element performance computer modelling; Preston, UK (15 Mar 1982).

The model used to describe fuel pellet fracture and relocation is an important feature of a fuel performance computer code. This model becomes especially important if the computer code is principally to be used for the evaluation of pellet clad interaction. The fracture and relocation model being developed for the B and W fuel performance code FUMAC was derived from an extensive data base. Cross sections of irradiated fuel rods were photographically magnified and measured to determine the configuration of the fragments of the fractured fuel pellets. Data, representing a wide range of LWR fuel designs and as-manufactured mechanical configurations, were catalogued and systematically reduced and then correlated as a function of the likely independent variables. These correlations define the key phenomenological behavior patterns which the relocation model must duplicate and indicate which mechanistic approaches are viable explanations of this behavior. The data base covers the burnup range from approximately one to 35 GWd/mtU and linear heat rates from less than 100 to nearly 700 W/Cm. This paper presents the correlated data base and the methods used to derive and interpret it. It was determined from this data base that pellet cracking is initially both power level and burnup dependent but tends to saturate eventually with continued steady irradiation. Fuel pellet relocation was found to be much more extensive than would be deduced from thermal considerations alone. Even at very low burnups fuel fragments were found to move outward until restrained by the cladding. The results also suggest that changes in internal resistance to heat flow within the pellets due to the opening of cracks may be as important as peripheral gap changes to the thermal modeler. The transient response and thermal implications of this model are recommended as primary areas for future investigation.

25553 (IWGFPT—13, pp 359-371) **KWU fission gas release model for LWR fuel rods: Description, data base and parametric study of the model.** Hering, W. (Kraftwerk Union A.G., Erlangen, Germany, F.R.). Mar 1983. NTIS (US Sales Only), PC A99/MF A01. File Number DE84900984. (CONF-820360—).

From IAEA specialists meeting on water reactor fuel element performance computer modelling; Preston, UK (15 Mar 1982).

The KWU model for fission gas release of LWR fuel is based on the physical processes of fission gas release as reported in the published literature and on KWU post irradiation examination results. The model is composed of two different submodels which predict the steady state and the transient fission gas release, respectively. 1) The steady state submodel can be divided into two main parts. Part 1: The fission gas produced is retained in the UO_2-matrix up to a certain saturation concentration, and all fission gas exceeding this matrix concentration is collected at grain boundaries. The temperature and burnup dependent saturation concentration of the matrix has been taken from experimental results published in the literature. Part 2: The rate of fission gas release df/dt to the void volume is assumed to be proportional to the gas inventory g at the grain boundaries: df/dt=K.g. The factor K depends on temperature, burnup and open porosity. 2) The submodel for transient fission gas release is presently based on the assumption that transient release is caused by grain boundary separations due to the growth of grain surface bubbles. The transient gas release calculated in the model depends on the inventory g of fission gas retained at grain boundaries and on the power increase Δq-prime during the transient. The fission gas release model is implemented in the KWU fuel rod computer code CARO and calibrated against measured fission gas release values of approximately 100 KWU fuel rods: PWR and BWR fuel rods with burnups up to 40 MWd/kg(U), unpressurized and pre-pressurized fuel rods, rods with mixed oxide fuel and test rods with center line temperature up to 2000 deg. C, rods under normal operation and rods with a transient at the end of operation. A parametric study demonstrates the characteristic behaviour of the model.

25554 (IWGFPT—13, pp 387-396) **Axial transport of fission gas in LWR fuel rods.** Kinoshita, M. (Central Research Inst. of Electric Power Industry, Japan). Mar 1983. NTIS (US Sales Only), PC A99/MF A01. File Number DE84900984. (CONF-820360—).

From IAEA specialists meeting on water reactor fuel element performance computer modelling; Preston, UK (15 Mar 1982).

With regard to fission gas transportation inside the fuel rod, the following three mechanisms are important: (1) a localized and time dependent fission gas release from UO_2 fuel to pellet/clad gap, (2) the consequent gas pressure difference between the gap and the plenum, and (3) the inter-diffusion of initially filled Helium and released fission gas such as Xenon. Among these three mechanisms, the 2nd mechanism would result in the one dimensional flow through P/C gap in the axial direction, while the 3rd would average the local fission gas concentration difference. In this paper, an attempt was made to develop a computerized model, LINUS (LINear flow and diffusion under Un-Steady condition) describing the above two mechanisms, items (2) and (3). The item (1) is treated as an input. The code was applied to analyse short length experimental fuel rods and long length commercial fuel rods. The calculated time evolution of Xe concentration along the fuel column shows that the dilution rate of Xe in commercial fuel rods is much slower than that in short experimental fuel rods. Some other sensi-

tivity studies, such as the effect of pre-pressurization, are also presented.

25555 (IWGFPT—13, pp 397-407) **Extension of a high temperature creep model to account for fuel sheath oxidation.** Boccolini, G.; Valli, G. (ENEA, Rome, Italy). Mar 1983. NTIS (US Sales Only), PC A99/MF A01. File Number DE84900984. (CONF-820360—).

From IAEA specialists meeting on water reactor fuel element performance computer modelling; Preston, UK (15 Mar 1982).

Starting from the high-temperature creep model for Zircaloy fuel sheathing, the NIRVANA (developed by AECL), a multilayer model, is proposed in this paper: it includes the outer oxide plus alpha retained layers, and the inner core of beta or alpha plus beta material, all constrained to deform with the same creep rate. The model has been incorporated into the SPARA fuel computer code developed for the transient analysis of fuel rod behaviour in the CIRENE prototype reactor, but it is in principle valid for all Zircaloy fuel sheathings. Its predictions are compared with experimental results from burst tests on BWR and PWR type sheaths; the tests were carried out at CNEN under two research contracts with Ansaldo Meccanico Nucleare and Sigen-Sopren, respectively.

25556 (IWGFPT—13, pp 559-566) **Parametric study with COMETHE.** Billaux, M.; Heckermann, H. (Societe Belge pour l'Industrie Nucleaire, Brussels; Rheinisch-Westfaelisches Elektrizitaetswerk A.G., Germany, F.R.). Mar 1983. NTIS (US Sales Only), PC A99/MF A01. File Number DE84900984. (CONF-820360—).

From IAEA specialists meeting on water reactor fuel element performance computer modelling; Preston, UK (15 Mar 1982).

The objective of this parametric study is twofold: to analyse the basic behaviour of LWR rods during steady state operation and power ramping, by separating the effects of various parameters; to generate basic functions to be used in a simpler calculation model to simulate the interaction between fuel and cladding at different power levels and to evaluate the margin to failure. In the first attempt interaction was assumed to depend on the difference between the actual power density and an interaction threshold. It was assumed that when the power is larger than the threshold a "conditioning function" could be applied and in the opposite event a "deconditioning function". It appeared quickly that it is not possible to analyse the mechanics of a fuel rod, ignoring the thermal aspects. Fission gas release is a very sensitive mechanism which can increase rapidly. Its thermal effects are very important on thermal expansion and fuel gaseous swelling. It follows that there is no simple relation between the fuel temperature and the power density. In those conditions it is difficult to express the "deconditioning" and the "conditioning" in terms of power history. The threshold power has therefore been replaced by the gap as basic variable for the calculation of the pellet cladding mechanical interaction. The present study shows an illustration of this new method applied to the analysis of different LWR fuels.

25557 (IWGFPT—13, pp 567-582) **Application of STAV5 code for the analysis of fission gas release in power reactor rods.** Nerman, H. (ASEA-ATOM AB, Vaesteraas, Sweden). Mar 1983. NTIS (US Sales Only), PC A99/MF A01. File Number DE84900984. (CONF-820360—).

From IAEA specialists meeting on water reactor fuel element performance computer modelling; Preston, UK (15 Mar 1982).

STAV5 is a design code for calculation of temperatures, fission gas release and rod pressure in BWR and PWR fuel rods. It includes the treatment of pellet cracks affecting conductivity and thermal expansion, gap closure by eccentric or relocated pellet fragments and oxide and crud build-up on the clad outer surface. The fission gas release model consists of two parts: High temperature release based on grain boundary saturation and low temperature release varying with fission rate of different isotopes. STAV5 has been benchmarked with a number of inpile thermal measurement experiments to as high burnup as 25 MWd/kg U. The main application of STAV5 is as a routine design tool for power reactor rods. It is also used to compare with PIE data. Examples are given from the analyses of fission gas release data from BWR rods from Oskarshamn 1 and Barsebeck 1 as well as PWR rods from Maine Yankee initial cores. The STAV5 evaluation show the importance of power histories, densification and the position in the assembly.

25558 (JAERI-M—84-202) **MINCS: a computer code for transient thermo-hydraulic analysis in a light water reactor system. MINCS-PIPE: a computer code for transient two-phase flow analysis in one-dimensional ducts.** Akimoto, Masayuki; Hirano, Masashi; Araya, Fumimasa; Harami, Taikan. (Japan Atomic Energy Research Inst., Tokyo). Nov 1984. 101p. (In Japanese). NTIS (US Sales Only), PC A06/MF A01. File Number DE86701417.

The analysis of transient two-phase flow phenomena is of much interest in the design and licensing of nuclear power reactors. Recently considerable progress in understanding and predicting transient two phase phenomena has been made by a combination of rigorous model development, advanced computational techniques and a number of small and large scale supporting experiments. However, it has been recognized that the greatest difficulty is associated with the development of the constitutive relations. MINCS-PIPE has been developed as a one-dimensional analytic tool based on various two-phase flow models from the one velocity and one temperature (1V1T) model to the two velocity and two temperature (2V2T) model to assess constitutive relations and to aid development of various experimental correlations. A description of the MINCS-PIPE as well as a developmental plan of MINCS are given in this report.

25559 (NUREG—0975-Vol.4) **Compilation of contract research for the Materials Engineering Branch, Division of Engineering Technology. Annual report for FY 1985. Volume 4.** (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering Technology). Mar 1986. 414p. NTIS, PC A18/MF A01 - GPO. File Number TI86901170.

The compilation of annual reports by contractors to the Materials Engineering Branch of the NRC Office of Research, concentrates on achievements in safety research for the primary system of commercial light water power reactors, particularly with regard to reactor vessels, primary system piping, steam generators and for non-destructive examination of primary system components. This report, covering research conducted during Fiscal Year 1985, is the fourth volume of the series of NUREG-0975, Compilation of Contractor Research for the Materials Engineering Branch, Division of Engineering Technology.

25560 (NUREG—1162) **Technical specifications, Perry Nuclear Power Plant, Unit No. 1 (Docket No. 50-440). Appendix "A" to license No. NPF-45.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Mar 1986. 479p. NTIS, PC A21/MF A01 - GPO. File Number TI86901238.

Technical specifications are provided for the Perry Nuclear Power Plant, Unit No. 1. (JDB)

25561 (CE-Trans—8144) **Corrosion and erosion problems in wet steam turbines.** Keller, H. (Central Electricity Generating Board, London (UK). Translations Section; Kraftwerk Union A.G., Erlangen (Germany, F.R.)). [1985]. Translated from A.I.M. Leige (Modern Power Stations), Paper 42, 1978. 21p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86900561.

The purpose of this report is to supply information on, and contrast, the corrosion and erosion problems encountered in wet steam turbines with those in conventional turbines. 22 refs., 10 figs. (JDB)

2102 Power Reactors, Non-breeding, Light-water Moderated, Non-boiling Water Cooled

REFER ALSO TO CITATION(S) 25367, 25406, 25545, 25546, 25548, 25549, 25551, 25552, 25553, 25554, 25555, 25556, 25557, 25558, 25559, 25561, 25603, 25604, 25605, 25606, 25607, 25608, 25666, 25668, 25671, 25672, 25673, 25674, 25675, 25676, 25677, 25681, 25682, 25683, 25684, 25685, 25687, 26098

25562 **(EGG-TMI—7108) Radiological impacts of transporting Three Mile Island core debris.** Cox, N.D. (EG and G Idaho, Inc., Idaho Falls (USA)). Jan 1986. Contract AC07-76ID01570. 22p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86007652.

This document presents an assessment of the radiological impacts of one cask shipment. It focuses on potential effects of the shipment on the public along the route. The document begins with a description of the shipping cask, followed by a description of the survivability tests required to confirm the cask design. Some actual accidents that similar casks have survived wholly intact are described. Next considered is the limit of radiation exposure dose rate that is imposed by regulatory agencies under normal conditions. No shipping of radioactive material is allowed unless the container is at or below the normal limit. A comparison is made between the normal radiation exposure limit and the radiation dose received annually by individuals from natural sources. Then, estimates of the radiation dose received by persons along the rail route in urban, suburban, and rural areas during normal transport are presented. Those times when the train stops for whatever reason (called rest stops) are considered also. Next, potential accident events are considered. Recent accident statistics are presented, and chances for an accident at different train velocities are estimated for any mile of track. The alternative of truck transport is considered briefly.

25563 **(ENEA-RT-TERM—84-3) Operating performance of LWR nuclear generating units. A survey of operating experience data through December 31, 1981.** Pia, S. (ENEA, Rome (Italy)). 1984. 70p. (In Italian). NTIS (US Sales Only), PC A04/MF A01. File Number DE86701415.

This work aims at reviewing, on the basis of historical data, the operational problem areas which explain the degree of availability and productivity achieved up to now by nuclear power plants in commercial operation in the world. The operating performance data of nuclear power plants are analysed with respect to plant type, size and other significant reference parameters and they are evaluated also by comparison with fossil generating unit data. Major performance indices data are presented for both nuclear and fossil units type and distribution of outage causes. Unplanned full outages caused by nuclear power plant equipment and components failure are particulary emphasized. The trend for unplanned full outages due to the failure of components shows decreasing numerical values in 1981 with respect to the previous years. But this result should be weighed with the increasing plant unavailability hours needed for maintenance and repair action (chiefly preventive maintenance on critical components). This means that the number and downtime of forced outage must be drastically reduced for economic reasons (production losses and problems associated with the unavailable unit unplanned replacement) as well as for plant safe and reliable operation (sudden unavailability of key components and frequency of transients associated with plant shutdown and routine startup operation).

25564 **(EPRI-NP—4512) Lifetime of PWR silver-indium-cadmium control rods. Final report.** Sipush, P.J.; Woodcock, J.; Chickering, R.W. (Westinghouse Electric Corp., Pittsburgh, PA (USA)). Mar 1986. 252p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI86920222.

A hot cell examination was performed on selected rodlets of a lead rod cluster control assembly (RCCA) which had experienced eleven cycles of operation in Point Beach Unit 1. The principal purpose of the program was to evaluate the performance of RCCAs. The hot cell examination of the rodlets involved detailed visual inspections, profilometry, metallography, cladding chemistry, dosimetry, scanning electron microscopy, corrosion tests, microhardness tests, absorber density measurements, and cladding tensile tests. Wear scars and a hairline crack in the cladding were evaluated. The results of the examinations and analysis of WEPCO site photographs led to an estimate of the service life for RCCAs which are used in Westinghouse 14 x 14 fuel assemblies. Also, wear scar widths were correlated with wear scar depths. The correlation may be used to estimate wear scar depths based on site photographs of wear scars for 14 x 14 RCCAs. The results of the program may be used as guidelines for RCCAs for 15 x 15 and 17 x 17 Westinghouse fuel designs. 10 refs., 89 figs., 26 tabs.

25565 **(GEND-INF—073) TMI-2 defueling tools engineering report.** (Bechtel North American Power Corp., Gaithersburg, MD (USA)). Feb 1986. Contract AC07-76ID01570. 180p. NTIS, PC A09/MF A01; 1; GPO Dep. File Number DE86009068.

This report describes the design and integration of the TMI-2 defueling system. It covers the technical and functional requirements, integration of the design of the equipment, and planned methods of implementation. The scope of the defueling system described is restricted to that which relates to accessing core debris within the reactor vessel and loading it into defueling canisters. The Appendix summarizes specific in-vessel tools to be used in defueling operations.

25566 (IAEA-TECDOC—344, pp 62-71) **Studies of Pu recycling in close-packed PWR lattices.** Johansson, E. (Studsvik Energiteknik AB, Nykoeping, Sweden). Sep 1985. NTIS (US Sales Only), PC A10/MF A01. File Number DE86701630. (CONF-8411237—).

From Technical committee and workshop on advanced light and heavy water reactor technology; Vienna, Austria (26 Nov 1984).

Recycling of Pu in close-packed PWR lattices has been studied by calculations with the cell code CASMO. Valuable information for such an unusual application of the code was obtained from tests against data from experiments in the PROTEUS reactor, Wuerenlingen. The emphasis in the power reactor calculations was on the net consumption of natural uranium and separative work. One result from the study is that fuel composed of Pu + enriched U might be a realistic alternative to fuel composed of Pu + depleted U and should therefore deserve further investigations.

25567 (IAEA-TECDOC—344, pp 72-83) **Design of a heterogeneous or homogeneous (Pu, U)O_2 core with a tight fuel rod lattice for an advanced pressurized light water reactor.** Broeders, C.H.M.; Dalle Donne, M. (Kernforschungszentrum Karlsruhe G.m.b.H., Germany, F.R. Inst. fuer Neutronenphysik und Reaktortechnik). Sep 1985. NTIS (US Sales Only), PC A10/MF A01. File Number DE86701630. (CONF-8411237—).

From Technical committee and workshop on advanced light and heavy water reactor technology; Vienna, Austria (26 Nov 1984).

The work performed at the Karlsruhe Nuclear Center for the neutron physics and thermohydraulic design of an APWR is described. Investigations have been restricted to the uranium/plutonium fuel cycle and to light water as coolant/moderator. The idea is to replace the core of a KWU 1300 MWe PWR with a high converting core with only minor changes in the internals of the reactor pressure vessel. Two reference designs - a homogeneous and a heterogeneous (seed and blanket) one - are presented, which satisfy the requirement of having a negative reactivity coefficient in case of complete water loss from the core region. With the assumed plutonium vector (PWR discharge and 10 years ex-core time), the conversion ratios for the homogeneous and the heterogeneous reactor are 0.90 and 0.96 respectively. The net electrical plant output is only marginally lower than that of the PWR (1-2%). The target discharge burnup of 50,000 MWd/thm may be reached with a 4-batch fuel cycle.

25568 (IAEA-TECDOC—344, pp 104-106) **Very long cycles in spectral shift reactors.** Gibson, I.H. (UKAEA Atomic Energy Establishment, Winfrith). Sep 1985. NTIS (US Sales Only), PC A10/MF A01. File Number DE86701630. (CONF-8411237—).

From Technical committee and workshop on advanced light and heavy water reactor technology; Vienna, Austria (26 Nov 1984).

The principle of the spectral shift reactor is to avoid parasitic loss of neutrons by absorption in a control material. This is done by reducing the degree of moderation so that neutrons are instead absorbed in the fertile species early in the cycle, and the loss of reactivity with burnup is compensated by increasing the level of moderation and so raising reactivity. One of the problems has been that the system also results in a very large leakage of neutrons. Many practical proposals have started with a start of cycle D_2O content of around 50% which gives adequate reactivity for a one year cycle. However, real gains in the system are achieved by having very much higher D_2O levels. The gains in convergence ratio are very considerable above 80% D_2O. Starting with 100% D_2O, high enrichments are needed, but very long cycles can, in principle, be obtained especially if the lattice is close packed to avoid the leakage problem. This paper reviews some calculations of spectral shift reactors with a range of heavy water concentration at start of cycle, of fuel to coolant ratios and of fissile/fertile combination.

25569 (IAEA-TECDOC—344, pp 107-112) **BR3 VULCAIN spectral shift experience.** Haas, D.; Vandenberg, C. (Societe Belge pour l'Industrie Nucleaire, Brussels). Sep 1985. NTIS (US Sales Only), PC A10/MF A01. File Number DE86701630. (CONF-8411237—).

From Technical committee and workshop on advanced light and heavy water reactor technology; Vienna, Austria (26 Nov 1984).

The paper contains a description of the operating experience with the spectral shift reactor BR3/VULCAIN and the associated experimental programme. The BR3 reactor was originally designed as a pressurized water reactor and was modified to a spectral shift reactor after the unloading of the first core.

25570 (IAEA-TECDOC—344, pp 126-134) **Design calculations of the low leakage core.** Ravnik, M.; Remec, I.; Trkov, A.; Kromar, M.; Slavic, S. (Institut Jozef Stefan, Ljubljana, Yugoslavia). Sep 1985. NTIS (US Sales Only), PC A10/MF A01. File Number DE86701630. (CONF-8411237—).

From Technical committee and workshop on advanced light and heavy water reactor technology; Vienna, Austria (26 Nov 1984).

The reactor calculation results for several low-leakage loading patterns for two-loop PWR core (NPP Krsko) for cycle three are presented. Comparisons are made between LLLP and standard loading pattern for the most important reactor physics core parameters (distributions, peakings, control rod worths, moderator temperature coefficient, etc.). Results can be useful for all 2-loop PWRs of Westinghouse type.

25571 (IAEA-TECDOC—344, pp 135-145) **Brazilian-German investigations on thorium utilization in KWU type PWRs. Results of nuclear core design.** Schlosser, G.J.; Andrade, E.P.; Carneiro, F.A.N. (Kraftwerk Union A.G., Erlangen, Germany, F.R.; NUCLEBRAS, Belo Horizonte, Brazil). Sep 1985. NTIS (US Sales Only), PC A10/MF A01. File Number DE86701630. (CONF-8411237—).

From Technical committee and workshop on advanced light and heavy water reactor technology; Vienna, Austria (26 Nov 1984).

The joint cooperative program initiated between KFA Juelich and NUCLEBRAS in 1979, with the participation of KWU and NUKEM covers the following topics: (1) nuclear design of Th-based fuel assemblies and PWR cores; (2) fabrication and testing of pellet type Th fuels; (3) spent fuel treatment of Th-based fuels. The paper presents the current status of the ongoing investigations related to (1), whereas (2) will be presented at the Wuerenlingen meeting in December 1984. The KWU standard 1300 MWe PWR is the reference reactor for the study. The results of nuclear core design are based on Th-fuel cycles using highly enriched uranium (HEU) or LWR Pu as initial fissile material. Strategy investigations included in the program are based on the need for natural uranium and separative work, calculated from the fuel cycle data of nuclear core design. Recycling is found essential for Th/HEU to achieve substantial savings in natural uranium and separative work, but there exists no direct need for these natural resources in the case of Th/Pu fuel cycles. Considerable savings of uranium and separative work stem from Th/Pu fuel via the replacement of U-fuel in existing reactors. The Th/Pu fuels may offer the potential of extending burnup to values where the need for early closure of the fuel cycle by reprocessing Th fuels could be avoided.

25572 (INIS-BR—428) **Utilization of the MAT method to analyze the nucleate boiling boundary in rod bundles subchannels.** Pedron, M.Q. (Minas Gerais Univ., Belo Horizonte (Brazil). Dept. de Engenharia Nuclear). 1983. 136p. (In Portuguese). NTIS (US Sales Only), PC A07/MF A01. File Number DE86701631.

The digital program PANTERA-1P, a new version of the COBRA-IIIC code, developed at CDTN, is directed to the thermal-hydraulic analysis of water cooled rod bundles and reactor cores, in steady state and transient conditions. Both the new and the old code versions have identical capacities in what concerns evaluation of fluid variables, nevertheless PANTERA-1P has better and faster performance. Improvements introduced in the scheme for solution of the conservation equations have contributed significantly to reduce the computer time, without affecting the accuracy of results. While the momentum equations are solved in COBRA-IIIC for the crossflow distribution, the PANTERA-1P code solves these equations for the pressure distribution by using the MAT method (Modified and Advanced Theta). The calculation of the pressure coefficient matrix has been optimized and simultaneous linear equations are solved optionally by means of the transpose elimination with storage requirements or the successive over-relaxation methods. The program presents others features specially in what concerns the thermal conduction model for fuel rods and the critical heat flux calculations options. A new input/output scheme is provided for optional use of the British or International System of Units. The results of the program are compared to the critical heat flux experimental data and to the results of COBRA-IIIC. Excellent agreement is observed in both cases.

25573 (IWGFPT—13, pp 475-490) **Interpretation of fuel centre temperature measurements on a suspected leaking fuel pin.** Ainscough, J.B.; Lang, C.; Clough, D.J. (UKAEA Springfields Nuclear Power Development Labs.; UKAEA Atomic Energy Research Establishment, Harwell. Metallurgy Div.). Mar 1983. NTIS (US Sales Only), PC A99/MF A01. File Number DE84900984. (CONF-820360—).

From IAEA specialists meeting on water reactor fuel element performance computer modelling; Preston, UK (15 Mar 1982).

In order to study fuel densification a series of single instrumented pin irradiations has been carried out in the High Pressure Water Loop of DIDO at Harwell. The behaviour of two of these pins was different from that expected. In the fifth test, where the fuel was 95% dense pellet UO_2 and expected to densify readily in-reactor, the fuel centre temperature increased from its starting value of approx. 1300 deg. C at a rate somewhat higher than expected on the basis of predicted densification rates. After about six days, the temperature increased rapidly and unexpectedly to 2100-2200 deg. C and remained steady at this level for a further eight days until a reactor trip occurred and the pin was unloaded. Predictions made using the HOTROD code imply a maximum fuel temperature of less than 1500 deg. C after densification. Post-irradiation examination confirmed that fission gas release had occurred, that the measured temperatures were consistent with the fuel microstructure and that the pin had a high internal gas pressure. The fourth pin in the series contained 97% dense UO_2 which was also expected to be dimensionally unstable. Qualitatively its behaviour was similar to that of the fifth pin though the temperatures throughout were lower. This pin experienced a number of major power cycles and failed after about 30 days in-reactor. It is probable that coolant ingress occurred in both pins via the thermocouple Hoke seal, degrading the filling gas conductivity and allowing the fuel to densify rapidly with consequent increase in the fuel/clad gap and hence in fuel temperature. These irradiations show that, for a short time at least, an apparently unfailed pin could operate undetected with temperatures significantly higher than those predicted for normal operation.

25574 (IWGFPT—13, pp 639-658) **SSYST: A code-system for analysing transient LWR fuel rod behaviour under off-normal conditions.** Borgwaldt, H.; Gulden, W. (Kernforschungszentrum Karlsruhe G.m.b.H., Germany, F.R.). Mar 1983. NTIS (US Sales Only), PC A99/MF A01. File Number DE84900984. (CONF-820360—).

From IAEA specialists meeting on water reactor fuel element performance computer modelling; Preston, UK (15 Mar 1982).

SSYST is a code-system for analysing transient fuel rod behaviour under off-normal conditions, developed conjointly by the Institut fuer Kernenergetik und Energiesysteme (IKE), Stuttgart, and Kernforschungszentrum Karlsruhe (KfK) under contract of Projekt Nukleare Sicherheit (PNS) at KfK. The main differences versus codes with similar applications are: (1) an open-ended modular code organisation, and (2) a preference for simple models, wherever possible. While the first feature makes SSYST a very flexible tool, easily adapted to changing requirements, the second feature leads to short execution times. The analysis of transient rod behaviour under LOCA boundary conditions takes 2 mins cpu-time (IBM-3033), so that extensive parametric studies become possible. The paper gives an outline of the overall code organisation and a general overview of the physical models implemented. Besides explaining the routine application of SSYST in the analysis of loss-of-coolant accidents, examples are given of special applications, which have led to a satisfactory understanding of the decisive influence of deviations from rotational symmetry on the fuel rod perimeter.

25575 (IWGFPT—13, pp 409-419) **PWR clad ballooning: The effect of circumferential clad temperature variations on the burst strain/burst temperature relationship.** Barlow, P. (National Nuclear Corp. Ltd., Whetstone, UK). Mar 1983. NTIS (US Sales Only), PC A99/MF A01. File Number DE84900984. (CONF-820360—).

From IAEA specialists meeting on water reactor fuel element performance computer modelling; Preston, UK (15 Mar 1982).

By experiment, it has been shown by other workers that there is a reduction in the creep ductility of Zircaloy 4 in the $\alpha+\beta$ phase transition region. Results from single rod burst tests also show a reduction in burst strain in the $\alpha+\beta$ phase region. In this report it is shown theoretically that for single rod burst tests in the presence of circumferential temperature gradients, the temperature dependence of the mean burst strain is not determined by temperature variations in creep ductility, but is governed by the temperature sensitivity of the creep strain rate, which is shown to be a maximum in the $\alpha+\beta$ phase transition region. To demonstrate this effect, the mean clad strain at burst was calculated for creep straining at different temperature levels in the α, $\alpha+\beta$ and β phase regions. Cross-pin temperature gradients were applied which produced strain variations around the clad which were greatest in the $\alpha+\beta$ phase region. The mean strain at burst was determined using a maximum local burst strain (i.e. a creep ductility) which is independent of temperature. By assuming cross-pin temperature gradients which are typical of those observed during burst tests, the calculated mean burst strain/burst temperature relationship gave good agreement with experiment. The calculations also show that when circumferential temperature differences are present, the calculated mean strain at burst is not sensitive to variations in the magnitude of the assumed creep ductility. This reduces the importance of the assumed burst criterion in the calculations. Hence a temperature independent creep ductility (e.g. 100% local strain) is adequate as a burst criterion for calculations under PWR LOCA conditions.

25576 (IWGFPT—13, pp 435-446) **EOLO-JR: A single rod burst test programme in the ESSOR reactor.** Jones, P.; Markovina, A.; Randles, J.; Simoni, O.; Zeyen, R. (Commission of the European Communities, Ispra, Italy. Joint Research Centre). Mar 1983. NTIS (US Sales Only), PC A99/MF A01. File Number DE84900984. (CONF-820360—).

From IAEA specialists meeting on water reactor fuel element performance computer modelling; Preston, UK (15 Mar 1982).

From October 1979 to October 1980, six tests were performed in the EOLO-JR irradiation device in the ESSOR reactor to study the ballooning behaviour of PWR fuel rods during simulated LOCA heat-up transients. A 1m highly instrumented, internally pressurized fuel rod, running at a constant peak linear power of approx. 4kW/m, was ramped at 3K/sec from 820K to a prefixed clad temperature in the range 970 to 1080K by reducing the helium coolant flow. This temperature was maintained until clad rupture, when the reactor was scrammed. This paper summarizes the tests performed and the major results obtained. This work was executed in the framework of a contract between the Commission of the European Community (JRC-Ispra) and the Italian Government.

25577 (IWGFPT—13, pp 447-460) **Utilization of "CONTACT" experiments to improve the fission gas release knowledge in PWR fuel rods.** Charles, M.; Abassin, J.J.; Bruet, M.; Baron, D.; Melin, P. (CEA Centre d'Etudes Nucleaires de Grenoble, 38, France. Dept. de Metallurgie; Fragema, 69 - Lyon, France). Mar 1983. NTIS (US Sales Only), PC A99/MF A01. File Number DE84900984. (CONF-820360—).

From IAEA specialists meeting on water reactor fuel element performance computer modelling; Preston, UK (15 Mar 1982).

The CONTACT experiments, which were carried out by the French CEA, within the framework of a CEA-FRAMATOME collaboration agreement, bear on the behaviour of in-pile irradiated PWR fuel rods. We will focus here upon their results dealing with fission gas release. The experimental device is briefly described, then the following results are given: the kinetics of stable fission gas release for various linear ratings; the instantaneous fractional release rates of radioactive gases versus their decay constant in the range 1.5 10^{6}-3.6 $10^{8}s^{1}$, for various burnups, as also the influence of fuel temperature. Moreover, the influence of the nature and the pressure of the filling gas upon the release is presented for various linear ratings. The experimental results are discussed and analysed with the purpose to model various physical phenomena involved in the release (low-temperature mechanisms, diffusion).

25578 (IWGFPT—13, pp 527-536) **Prediction of the UO_2 fission gas release data of Bellamy and Rich using a model recently developed by Combustion Engineering.** Freeburn, H.R.; Pati, S.R. (Combustion Engineering, Inc., Windsor, CT, USA. Nuclear Power Systems). Mar 1983. NTIS (US Sales Only), PC A99/MF A01. File Number DE84900984. (CONF-820360—).

From IAEA specialists meeting on water reactor fuel element performance computer modelling; Preston, UK (15 Mar 1982).

The trend in the Light Water Reactor industry to higher discharge burnups of UO_2 fuel rods has initiated the modification of existing fuel rod models to better account for high burnup effects. A model recently developed by Combustion Engineering, Inc. (C-E) for fission gas release from UO_2 fuel recognizes the separate effects of temperature-dependent and temperature-independent release mechanisms. This model accounts for a moderate burnup enhancement that is based on a concept of a saturation inventory existing for the intra- and inter-granular storage of fission gas within the fuel pellet. The saturation inventory, as modelled, is strongly dependent on the local temperature and the changing grain size of the fuel with burnup. Although the fitting constants of the model were determined solely from more current gas release data from fuel more typical of the C-E product line, the model, nonetheless, provides an excellent prediction of the Bellamy and Rich data over the entire burnup range represented by the data (+-1.6% gas release at a 1σ level). The ability to obtain a good comparison with this data base provides additional support for the use of the particular separation of the effects of thermal diffusion and burnup enhancement on fission gas release that is embodied in the model. Furthermore, the degree of burnup enhancement in the model is believed to be moderate enough to suggest that this high burnup effect should not impede the extension of discharge burnup limits associated with current design fuel rods for Pressurized Water Reactors.

25579 (IWGFPT—13, pp 547-558) **Mechanical modelling of PCI with FRAGEMA and CEA finite element codes.** Joseph, J.; Bernard, Ph.; Atabek, R.; Chantant, M. (Fragema, 69 - Lyon, France; CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette, France. Dept. de Technologie). Mar 1983. NTIS (US Sales Only), PC A99/MF A01. File Number DE84900984. (CONF-820360—).

From IAEA specialists meeting on water reactor fuel element performance computer modelling; Preston, UK (15 Mar 1982).

In the framework of their common program, CEA and FRAGEMA have undertaken the mechanical modelization of PCI. In the first step two different codes, TITUS and VERDON, have been tested by FRAGEMA and CEA respectively. Whereas the two codes use a finite element method to describe the thermomechanical behaviour of a fuel element, input models are not the same for the two codes: to take into account the presence of cracks in UO_2, an axisymmetric two dimensional mesh pattern and the Druecker-Prager criterion are used in VERDON and a 3D equivalent method in TITUS. Two rods have been studied with these two methods: PRISCA 04bis and PRISCA 104 which were ramped in SILOE. The results show that the stresses and strains are the same with the two codes. These methods are further applied to the complete series of the common ramp test rods program of FRAGEMA and CEA.

25580 (IWGFPT—13, pp 671-684) **Ballooning and flow blockage for high alpha LOCA conditions.** Mohr, C.L.; Hesson, G.M. (Battelle Pacific Northwest Labs., Richland, WA, USA). Mar 1983. NTIS (US Sales Only), PC A99/MF A01. File Number DE84900984. (CONF-820360—).

From IAEA specialists meeting on water reactor fuel element performance computer modelling; Preston, UK (15 Mar 1982).

Studies of the rupture and flow blockage characteristics of full-length Pressurized Water Reactor fuel rods under LOCA conditions have been performed to evaluate maximum cladding strain conditions for hypothetical "flat top transients" in the high-alpha temperature range. This work, performed as part of the "LOCA Simulation in NRU" program, was sponsored by the United States Nuclear Regulatory Commission (NRC) and the United Kingdom Atomic Energy Authority (UKAEA). Cladding ballooning and rupture in the high-alpha temperature range of 1023K to 1123K reach a maximum condition. Three nuclear-heated full-length 32-rod PWR fuel bundle tests have been performed in this temperature range. The results of these tests indicate that although individual rod strains at the rupture site of 50% to 60% are common, peak average bundle strains of the ruptured rod never were greater than 37%. Ballooning in all cases extended over a length of at least 150 cm. There was no apparent degradation in bundle heat transfer.

25581 (IWGFPT—13, pp 685-703) **Pre-test prediction and post-test analysis of PWR fuel rod ballooning in the MT-3 in-pile LOCA simulation experiment in the NRU reactor.** Donaldson, A.T.; Horwood, R.A.; Healey, T. (Central Electricity Generating Board, Berkeley, UK. Berkeley Nuclear Labs.). Mar 1983. NTIS (US Sales Only), PC A99/MF A01. File Number DE84900984. (CONF-820360—).

From IAEA specialists meeting on water reactor fuel element performance computer modelling; Preston, UK (15 Mar 1982).

The USNRC and the UKAEA have jointly funded a series of in-pile LOCA simulation experiments in the Canadian NRU reactor in order to secure further information on the thermal hydraulic and clad deformation response of PWR fuel rod bundles. Test MT-3 in the series was performed using reflood rate and rod internal pressure conditions specified by the UK nuclear industry. The parameters were selected to ensure the development of a near-isothermal clad temperature history during which Zircaloy was required to balloon and rupture near the alpha-alpha/beta phase transition. Specification of the reflood rate conditions was assisted by the performance of a precursor test on an unpressurised rod bundle and by complementary application of appropriate thermal hydraulic analyses. Identification of the rod internal pressure needed to cause ballooning and rupture was achieved using a creep deformation model, BALLOON, in conjunction with the clad thermal history defined by the prior thermal hydraulic test. This paper presents the basis of the BALLOON analysis and describes its application in calculating the fill gas pressure for rods MT-3, their axial ballooning profile and the clad temperature at peak radial strain elevations.

25582 (IWGFPT—13, pp 705-714) **Thermal hydraulic considerations in the design and analysis of the United Kingdom test in the Battelle/NRU experiment.** Gibson, I.H.; Coddington, P. (UKAEA Atomic Energy Establishment, Winfrith). Mar 1983. NTIS (US Sales Only), PC A99/MF A01. File Number DE84900984. (CONF-820360—).

From IAEA specialists meeting on water reactor fuel element performance computer modelling; Preston, UK (15 Mar 1982).

In January 1981 discussions with the UK nuclear industry led to the conclusion that it would be advantageous to participate in the USNRC LOCA Simulation Project. This was being carried out by Battelle Pacific Northwest Laboratory in a loop in the NRU reactor at Chalk River. Following the very successful first ballooning test, MT1, in this facility, it was decided that the UK test should try to simulate a near isothermal transient and to produce inter-active balloons in the high α or low α/β region of the Zircaloy phase diagram. There was an important proviso that the transient should be within the envelope of transients relevant to the Sizewell B Safety Case. It was apparent, too, that the tests would produce valuable thermal hydraulic data which would aid in understanding the difficult heat transfer conditions above a quench front. This paper presents the basis of the thermal hydraulic issues in the design of the experiments, as well as methods of calculation and comparison of the experimental data with the results of simulation calculations that have been carried out with RELAP and MABEL codes.

25583 **(NUREG/CR—4207) Fault tree application to the study of systems interactions at Indian Point 3.** Youngblood, R.; Hanan, N.; Fitzpatrick, R.; Xue, D.; Bozoki, G.; Fresco, A.; Papazoglou, I.; Mitra, S.; MacDonald, G.; Mazour, T. (Brookhaven National Lab., Upton, NY (USA)). Jan 1986. Contract AC02-76CH00016. 334p. (BNL-NUREG—51872). NTIS, PC E16/MF $17.95 - GPO. File Number TI86009171.

Includes 33 sheets of 48x reduction microfiche.

This report describes an application of fault tree methods to search for systems interactions at Indian Point 3. This project was carried out in support of the resolution of Unresolved Safety Issue A-17 on Systems Interaction. Here, the methods are introduced, the findings are presented, and comments on the methods are offered. Findings are presented in the following manner. Systems interactions which may qualitatively violate regulatory requirements (regardless of their probability) are discussed; additionally, a probabilistically ranked list of system interactions is provided. This study resulted in the discovery of a previously undetected active single failure causing loss of low pressure injection. After verifying this finding, the licensee took immediate corrective actions, including a design modification to the switching logic for one of the safety buses, as well as procedural changes.

2103 Power Reactors, Non-breeding, Graphite Moderated

REFER ALSO TO CITATION(S) 25667

25584 (IWGFPT—13, pp 491-510) **Comparison of measured fission gas release for Windscale AGR fuel irradiated above 18 GWd/tU with those predicted using the computer code MINIPAT D.** Beatham, N.; Hargreaves, R.; Walker, R.D.; Kirkbride, R. (UKAEA Windscale Nuclear Power Development Labs.). Mar 1983. NTIS (US Sales Only), PC A99/MF A01. File Number DE84900984. (CONF-820360—).

From IAEA specialists meeting on water reactor fuel element performance computer modelling; Preston, UK (15 Mar 1982).

MINIPAT D is a computer code for predicting fission product gas release into the voidage of thermal reactor fuel pins. It also calculates the variation of internal pressure within a pin during irradiation. This paper examines how well the code predicts fission gas release from high burn-up AGR fuel. All the data are provided from the Windscale prototype AGR. Fuel pins included in the investigation came from elements where the mean burn-up exceeded

18 GWd/tU. Values of predicted-to-measured gas release (p/m) for the mean pin in an element have been obtained for pins from eighteen stringers. Whilst there is a spread in the values of p/m, on average MINIPAT D predicts correctly gas release volumes from AGR fuel irradiated above 18 GWd/tU. An analysis conducted in terms of ln(p/m) gives a standard deviation of approx. 0.7. This is equivalent to a factor of 2 in p/m. The majority of the spread in ln(p/m) can be attributed to uncertainty in the characterisation of the irradiation conditions and fuel pin properties. The fission gas release measurements for Windscale AGR pins belonging to the same element exhibit a round-the-ring variation which can sometimes be quite significant i.e. a factor of four minimum to maximum. This variation is primarily due to the presence of cross-channel neutron flux tilts during irradiation. It is demonstrated in this paper that MINIPAT D is in general capable of modelling these variations.

25585 **(JAERI-M—84-179) Computer programs for analysing two-dimensional permeation flow within horizontal thermal insulation.** Kondo, Yasuo; Tadokoro, Yoshihiro; Hishida, Makoto; Okamoto, Masaru; Tanaka, Toshiyuki; Sanokawa, Konomo. (Japan Atomic Energy Research Inst., Tokyo). Oct 1984. 60p. NTIS (US Sales Only), PC A04/MF A01. File Number DE86701420.

A computer program has been developed to analyze the behavior of the permeation flow occurring when partition plates are placed in a thermal insulation layer within a hot gas duct of a high-temperature gas-cooled reactor. This computer program simulates a single thermal insulation layer divided by partition plates and treats this layer as two-dimensional and homogeneous. In the thermal insulation layer, it is assumed that the D'arcy's law rules the fluid motion and also the temperatures of local gas and insulation are equal. In calculation the extrapolated Liebman method was employed for both momentum and energy equations and a centered difference method was applied to the equations to avoid the divergence of the solutions. Convergence of numerical solutions and stability of computation were successfully obtained when the state of convection within thermal insulation layer is in steady or quasi-steady states where forced convection is more dominant than natural convection. The input and output data are briefly described with their formats, and the elements of the program including the main program and the functions of the subroutines are appended.

25586 **(JAERI-M—84-201) Natural and mixed convections in two parallel channels.** Shiina, Yasuaki; Fujimura, Kaoru. (Japan Atomic Energy Research Inst., Tokyo). Nov 1984. 34p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. File Number DE86701421.

Reactor core reverse flow experiments were made to observe heat transfer and fluid characteristics of forced cooling failure accident of HTGR reactor core. Two channels (heated and cooled) were used in this experiment to simulate HTGR multi-channel core. Wall temperature, flow rate and temperature distribution in fluid were measured for natural and mixed convections. The results show that natural convection flow rate is proportional to Grashof number and that hysteresis between wall temperature and flow rate is observed for mixed convection.

25587 **(Juel—1996) Theoretical and experimental investigation of acoustically induced vibrations in thermal insulation systems in air and helium at pressures up to 50 bars.** Bereczky, A. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorbauelemente; Technische Hochschule Aachen (Germany, F.R.)). Jun 1985. 166p. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number DE86751112.

In High Temperature Gas-cooled Reactors thermal insulating systems are installed. The components of these systems are forced to mechanical vibrations by blower noise or pipe flow. In this paper the coupling between a liner insulation and a sound field has been investigated in air and helium at static pressure up to 50 bars and SPL up to 160 dB. In the theoretical part it is shown that, by applying the law of acoustic reciprocity, the response of a structure in a diffuse sound field can be calculated. The main parameter influencing the coupling between a sound field and a structure is the radiation efficiency of the structure. The highest degree of coupling occurs at the coincidence frequency. In the experimental part the radiation efficiency of a cover plate insulation was measured. Then the system was excited by narrow - or broadband noise, and the structure response was measured. The experimental results and theoretical predictions are in good agreement. From theory and experiment a modelling rule was derived. This rule shows under which conditions model test must be performed and how the results can be extrapolated to original reactor conditions. (orig.).

25588 **(Juel-Spez—326) Chemical and physical analysis of core materials for advanced high temperature reactors with process heat applications.** Nickel, H. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorwerkstoffe und Heisse Zellen). Aug 1985. 14p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86751114.

Various chemical and physical methods for the analysis of structural materials have been developed in the research programmes for advanced high temperature reactors. These methods are discussed using as examples the structural materials of the reactor core - the fuel elements consisting of coated particles in a graphite matrix and the structural graphite. Emphasis is given to the methods of chemical analysis. The composition of fuel kernels is investigated using chemical analysis methods to determine the heavy metals content (uranium, plutonium, thorium and metallic impurity elements) and the amount of non-metallic constituents. The properties of the pyrocarbon and silicon carbide coatings of fuel elements are investigated using specially developed physiochemical methods. Regarding the irradiation behaviour of coated particles and fuel elements, methods have been developed for examining specimens in hot cells following exposures under reactor operating conditions, to supplement the measurements of in-reactor performance. For the structural graphite, the determination of impurities is important because certain impurities may cause pitting corrosion during irradiation. The localized analysis of very low impurity concentrations is carried out using spectrochemical d.c. arc excitation, local laser and inductively coupled plasma methods. (orig.).

2104 Power Reactors, Non-breeding, Otherwise Moderated Or Unmoderated

REFER ALSO TO CITATION(S) 25545, 25576

25589 (IAEA-TECDOC—344, pp 146-149) **General overview of CANDU advanced fuel cycles program: rationale and thrusts.** Slater, J.B. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Sep 1985. NTIS (US Sales Only), PC A10/MF A01. File Number DE86701630. (CONF-8411237—).

From Technical committee and workshop on advanced light and heavy water reactor technology; Vienna, Austria (26 Nov 1984).

The pace and focus of the CANDU advanced fuel cycle program is influenced by a number of considerations, including the current status and future prospects for the nuclear fuel supply industry, both in Canada and the rest of the world. Important components of the analysis are the uranium mining industry, the reprocessing industry, competition from fossil fuels, and the status and prospects for the liquid metal fast breeder reactor. Current assessments indicate a significant future market for a CANDU advanced converter reactor which will exist for many decades. The CANDU concept is well poised for development in an advanced converter role since the fuel cycle characteristics of the current commercial version of CANDU are those of low fissile inventory and high conversion ratio. Consequently, no major design changes would be required to the reactor design or method of operation, and the research and development program can focus on fuel performance characteristics, future improvements in neutron economy, and the technology required to permit recycle fuelling of CANDU. In all areas the focus of the program is to achieve the highest levels of efficiency in fuel usage together with minimum costs. The R and D program may be roughly divided into two components which have a near- and long-term focus, respectively. The near-term focus is on the technology to implement improved once-through cycles and mixed oxide (plutonium-uranium oxides) recycle in CANDU and on technologies to separate zirconium isotopes. Included is work on those technologies which would allow a CANDU-LWR strategy to

be developed in a growing nuclear power system. For the longer-term, activities are focused on those technologies and fuel cycles which would be appropriate in a period when nuclear fuel demand significantly exceeds mined uranium supplies. Fuel cycles and systems under study are thorium recycle, CANDU fast breeder systems and electro-nuclear fissile breeders.

25590 (IAEA-TECDOC—344, pp 150-162) **Development potential and advanced fuel cycles in KWU type PHWRs.** Frischengruber, K.; Dusch, F. (Kraftwerk Union A.G., Erlangen, Germany, F.R.). Sep 1985. NTIS (US Sales Only), PC A10/MF A01. File Number DE86701630. (CONF-8411237—).

From Technical committee and workshop on advanced light and heavy water reactor technology; Vienna, Austria (26 Nov 1984).

The KWU type PHWR was developed using natural uranium as fuel. Therefore, many design features of this reactor type are influenced by the principle of neutron economy. One characteristic is onpower refuelling and fuel shuffling. Excellent fuel utilization is also met with the pressure vessel concept of the KWU type PHWR allowing for low inventory of structural materials and maintaining high-purity of heavy water. Successful operation of the 367 MWsub(e) Atucha I power plant during the last 10 years has shown the achievement of commercial viability. The safety concept, in principle, is derived from the PWR technology, considering the special features of heavy water reactors. The high safety level is documented by risk studies. For many years KWU has been devoted to investigation on alternative fuel cycles with more efficiency in their use of uranium. In this paper the following main types of investigated fuel cycles are considered: Once-through natural uranium as the reference case. In this fuel cycle the uranium consumption of the PHWR is 80% of the consumption of thermal LWRs; Once-through cycle using low enriched uranium (LEU-cycle). This cycle offers further reduction of uranium consumption and increasing economy; Recycling of plutonium offers the advantage of reduced natural uranium consumption and lower fuel cycle costs without enrichment services; Recycling of thorium together with high enriched uranium as make-up fuel. This alternative offers further expanding of nuclear fuel resources; Tandem principle. Insertion of fuel assemblies consisting of fuel rods discharged from spent LWR assemblies. The technical concept of KWU's PHWRs does not require important changes on systems or components when changing from one fuel cycle to another. However, in many cases an optimum economical result can be achieved only when the design is made for a specific fuel alternative.

25591 (IAEA-TECDOC—344, pp 163-164) **Thorium utilization in India's power reactor programme.** Balakrishnan, K. (Bhabha Atomic Research Centre, Bombay, India. Reactor Engineering Div.). Sep 1985. NTIS (US Sales Only), PC A10/MF A01. File Number DE86701630. (CONF-8411237—).

From Technical committee and workshop on advanced light and heavy water reactor technology; Vienna, Austria (26 Nov 1984).

The paper contains a description of the incentives in India for implementing the Thorium fuel cycle. A listing of various experimental facilities and their main programme goals are described together with possible future steps that have to be made in India to establish the thorium fuel cycle.

25592 (IAEA-TECDOC—344, pp 165-168) **Once-through, low enriched uranium-thorium cycle as advanced HWR intermediate option.** Lungu, S.; Isbasescu, M.; Anton, V.; Raica, V. (Institutul de Reactori Nucleari Energetici, Pitesti, Romania). Sep 1985. NTIS (US Sales Only), PC A10/MF A01. File Number DE86701630. (CONF-8411237—).

From Technical committee and workshop on advanced light and heavy water reactor technology; Vienna, Austria (26 Nov 1984).

A once-through, low-enriched uranium-thorium cycle, based on use of separate channels fuelled with UO_2 and ThO_2, is discussed in the paper. The reference case is a 638 Mwe CANDU-PHW reactor. Core structures for two cases (4w/o and 5.5w/o U-235) are presented. In the first, one half of the channels are fed with LEU bundles, one sixth with fresh ThO_2 (first irradiation) and one third with irradiated ThO_2 bundles (second irradiation); in the second, 40% are LEU channels, 20% first irradiation ThO_2 and 40% second irradiation ThO_2 channels. Discharge exposures amount respectively to 47/58 Mwd/Kg HE for LEU bundles and 71/72 Mwd/kg HE for ThO_2 bundles. The fuel is assumed to be identical in design with that of a standard CANDU reactor, except that hollow pellets would be used both for ThO_2 and LEU-UO_2 elements, and that thorium rod cladding would be 0.6 mm thick. The cycle would have a lower uranium consumption than other once-through (natural uranium or slightly enriched uranium) cycles in PHW reactors, while fuel cycle costs would be comparable and fuel enrichment level is still low.

25593 (IAEA-TECDOC—344, pp 172-180) **Physics characteristics of CANDU cores with advanced fuel cycles.** Garvey, P.M. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Sep 1985. NTIS (US Sales Only), PC A10/MF A01. File Number DE86701630. (CONF-8411237—).

From Technical committee and workshop on advanced light and heavy water reactor technology; Vienna, Austria (26 Nov 1984).

The current generation of CANDU reactors, of which some 20 GWE are either in operations or under construction worldwide, have been designed specifically for the natural uranium fuel cycle. The CANDU concept, due to its D_2O coolant and moderator, onpower refuelling and low absorption structural materials, makes the most effective utilization of mined uranium of all currently commercialized reactors. An economic fuel cycle cost is also achieved through the use of natural uranium and a simple fuel bundle design. Total unit energy costs are achieved that allow this reactor concept to effectively compete with other reactor types and other forms of energy production. There are, however, other fuel cycles that could be introduced into this reactor type. These include the slightly enriched uranium fuel cycle, fuel cycles in which plutonium is recycled with uranium, and the thorium cycle in which U-233 is recycled. There is also a special range of fuel cycles that could utilize the spent fuel from LWR's. Two specific variants are a fuel cycle that only utilizes the spent uranium, and a fuel cycle in which both the uranium and plutonium are recycled into a CANDU. For the main part these fuel cycles are characterized by a higher initial enrichment, and hence discharge burnup, than the natural uranium cycle. For these fuel cycles the main design features of both the reactor and fuel bundle would be retained. Recently a detailed study of the use in a CANDU of mixed plutonium and uranium oxide fuel from an LWR has been undertaken by AECL. This study illustrates many of the generic technical issues associated with the use of Advanced Fuel Cycles. This paper will report the main findings of this evaluation, including the power distribution in the reactor and fuel bundle, the choice of fuel management scheme, and the impact on the control and safety characteristics of the reactor.

25594 (IAEA-TECDOC—344, pp 181-190) **Neutron analysis of a heavy water reactor controlled by spectral shifting.** Alcala, F. (Junta de Energia Nuclear, Madrid, Spain. Div. de Reactores Experimentales). Sep 1985. NTIS (US Sales Only), PC A10/MF A01. File Number DE86701630. (CONF-8411237—).

From Technical committee and workshop on advanced light and heavy water reactor technology; Vienna, Austria (26 Nov 1984).

We have tried to analyze in this paper some aspects of the nuclear design and neutron performance of heavy water-moderated fuel cells when they are controlled by spectral shifting. Without carrying out an optimization in size of the fuel cell, we started fixing the fuel type (metallic natural uranium of 18.5 g/cm^3 in rods of 1.0 cm of radius); in order to get core reactivities comparable to those loaded at BOC by typical PHWR, we chose the equivalent radius of the unit cell equal to 4.5 cm. In this way, for a reactor of 1000 Mw (thermal), with equal core diameter and height, and mean linear power density of 7.1 kw/ft, it has got an effective multiplication factor of 1.133 and 1.073 for cold and hot conditions, respectively. The control of the reactivity is achieved by diluting 5 atoms of ^{10}B by each million of deuterium atoms (conventionally controlled cell, CCC) or by substituting 45% of the heavy water

volume in the core by graphite (spectral shift controlled cell, SCC). From the economic point of view related with the burnup cycle length we found a maximum cycle length of 6,900 Mwd/tonne for the CCC and 7,850 Mwd/tonne for the SCC which means that the last type of cells extends its cycle length in a 13.8% with respect to the first one. From the point of view of the environmental impact there is a significant reduction of the tritium production in the SCC with respect to the CCC because of the less volume of heavy water present in its core. From the point of view of the non-proliferative character of this cell, the SCC produces, in absolute terms, a bigger amount of plutonium than the CCC; however, at the end of their respective cycles, the proliferative index or $^{239}Pu/Pu$ concentration ratio of each cell is 0.710 and 0.685 for the CCC and SCC, respectively. Finally, the above characteristics of the SCC are more relevant as smaller is the cell size because of its harder neutron spectrum.

25595 (IAEA-TECDOC—344, pp 168-172) **Economic and system aspects of CANDU advanced fuel cycles.** Slater, J.B.; Garvey, P.M. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Sep 1985. NTIS (US Sales Only), PC A10/MF A01. File Number DE86701630. (CONF-8411237—).

From Technical committee and workshop on advanced light and heavy water reactor technology; Vienna, Austria (26 Nov 1984).

It is somewhat a paradox that Canada, which ranks as one of the world's leading uranium producers and has large economic uranium resources, should also have developed the CANDU reactor. This reactor is the most fuel efficient of all reactor types which are commercially available at the present time. The explanation of the paradox is that the design basis of the CANDU was established three decades ago when the full extent of Canadian uranium resources was unknown, and an early transition to recycle fuelling was anticipated as being necessary to sustain a growing power generation system. Consequently, the objectives of fuel efficiency and flexibility in using a variety of uranium, plutonium and thorium fuels were established at an early stage. One result of this is the ability to use the current design of CANDU in an advanced converter role with very little change in reactor design or operating procedures. As a result, in projections of future power costs, all major uncertainty is focused on fuel cycle parameters since the capital and operating costs are well defined by current commercial experience. The paper will examine the economic and resource characteristics of CANDU in an advanced converter role, both in terms of stand-alone technology and as a partner in a CANDU-light-water-reactor and in a CANDU-fast-breeder-reactor system. The use of results to establish cost targets to guide the current research and development program will be discussed, together with considerations of deployment strategy.

25596 (INIS-BR—419, pp 153-166) **Dynamic behaviour of a typical PHWR under earthquake load conditions.** Fischer, U.; Brandt, K.; Krutzik, N.J. (Kraftwerk Union A.G., Offenbach am Main, Germany, F.R.). 1984. NTIS (US Sales Only), PC A18/MF A01. File Number DE86701405. (CONF-8410303—Vol.3).

From Conference on structural analysis and design of nuclear power plant; Porto Alegre, Brazil (3 Oct 1984).

The paper deals with dynamic calculations for a PHWR reactor building founded on rock and on a base isolation system. The zero period accelerations, displacements, mode shapes and the floor response spectra of both calculations are compared.

25597 (INIS-BR—419, pp 193-206) **Canadian approach to seismic design of CANDU-PHW nuclear power plants.** Duff, C.G.; Usmani, S.A. (Atomic Energy of Canada Ltd., Ottawa, Ontario). 1984. NTIS (US Sales Only), PC A18/MF A01. File Number DE86701405. (CONF-8410303—Vol.3).

From Conference on structural analysis and design of nuclear power plant; Porto Alegre, Brazil (3 Oct 1984).

The seismic design approach which is now employed in Canada and how it was arrived at is described. The design requirements, criteria and methods for seismic qualification of CANDU nuclear power plant are described.

25598 (IWGFPT—13, pp 421-433) **Development of PCMI analysis code for Fugen MOX fuel rod.** Domoto, K.; Yokouchi, Y.; Kaneko, M.; Shakudo, T. (Power Reactor and Nuclear Fuel Development Corp., Tokyo, Japan; Nuclear Fuel Industries Ltd., Tokai, Japan). Mar 1983. NTIS (US Sales Only), PC A99/MF A01. File Number DE84900984. (CONF-820360—).

From IAEA specialists meeting on water reactor fuel element performance computer modelling; Preston, UK (15 Mar 1982).

Fugen, a 165 MWe prototype of a heavy water moderated boiling light water cooled reactor, has been operating since March 1979. The reactor power is controlled by 49 control rods and boron concentrations in heavy water. In order to clarify PCMI phenomena and to find the optimized Fugen reactor operation, the following R and D works are under way: (1) In-pile tests and the post irradiation examinations for clarifying PCMI; (2) Development of design and analysis codes, based on the above experiments. The skeleton of the computer modelling will be reported in another paper in this meeting. The applicability of the developed modelling for the PCMI analysis of Fugen fuel was checked by comparing the calculation and instrumented irradiation data in Halden. With the aid of this analysis code, we are expecting to characterize the PCMI phenomena during various kinds of power changes, such as load follow operation.

25599 (IWGFPT—13, pp 537-546) **Model for fission product distribution in CANDU fuel.** Muzumdar, A.P. (Nuclear Studies and Safety Dept., Ontario Hydro, Toronto, Canada). Mar 1983. NTIS (US Sales Only), PC A99/MF A01. File Number DE84900984. (CONF-820360—).

From IAEA specialists meeting on water reactor fuel element performance computer modelling; Preston, UK (15 Mar 1982).

This paper describes a model to estimate the distribution of active fission products among the UO_2 grains, grain-boundaries, and the free void spaces in CANDU fuel elements during normal operation. This distribution is required for the calculation of the potential release of activity from failed fuel sheaths during a loss-of-coolant accident. The activity residing in the free spaces ("free" inventory) is available for release upon sheath rupture, whereas relatively high fuel temperatures and/or thermal shock are required to release the activity in the grain boundaries or grains. A preliminary comparison of the model with the data from in-reactor sweep-gas experiments performed in Canada yields generally good agreement, with overprediction rather than under prediction of radiologically important isotopes, such as I^{131}. The model also appears to generally agree with the "free" inventory release calculated using ANS-5.4.

25600 (IWGFPT—13, pp 607-614) **Fuel deformation/thermal hydraulic interaction during high temperature transients.** Sills, H.E.; Allan, J.D. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.; Scientific Software, Peterborough, Ontario, Canada). Mar 1983. NTIS (US Sales Only), PC A99/MF A01. File Number DE84900984. (CONF-820360—).

From IAEA specialists meeting on water reactor fuel element performance computer modelling; Preston, UK (15 Mar 1982).

CANDU fuel has a number of design features which affect fuel bundle behaviour during high temperature transients (1) - natural UO_2, short fuel bundles, thin collapsible sheaths, spacer appendages, close fuel element spacing, pressure tubes, horizontal channel orientation and cool moderator. The horizontal orientation can lead to fuel element sag and also to flow separation at low coolant flows. Depressurization of the primary heat transport system can produce non-uniform sheath ballooning. To develop computer models to simulate the complex interactions which may occur over a wide spectrum of such hypothetical accidents, we are following two complimentary coding paths. The first, to yield simulations in the short term, involves linking available computer programs into a code system (COBRA/PASSIVE) using the job control language logic facilities. The second code (CANSIM), employing logic controlled mesh refinement, will provide the scoping capability required for core analysis. These codes must represent the interaction

and feedback effects of fuel element deformation (bowing, sagging and ballooning) and fuel subchannel thermalhydraulics. Of primary concern is the onset of fuel failure, activity release at failure and continuance of coolable geometry. The COBRA/PASSIVE system uses the COBRA-IV subchannel code to evaluate thermalhydraulic response. COBRA was selected due to its availability, documentation and support. A membrane sheath model using our transient, microstructural Zircaloy creep law (2) is used to predict fuel element deformation. A geometry update module supplies COBRA with the necessary information on subchannel deformation. The PASSIVE module controls cyclic loading/off-loading, provides communication links and performs time step selection. An application of this system to simulate the effect of fuel element deformation on subchannel thermalhydraulics during a reactor transient is described.

2105 Power Reactors, Breeding

REFER ALSO TO CITATION(S) 25616, 25670, 25676, 25690, 25692

25601 (ENEA-RT-VEL—84-4) **Experimentation with PEC channel prototype. Tests in sodium, washing and assessment after washing.** Caponetti, R.; Iacovelli, M. (ENEA, Rome (Italy)). 1984. 22p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701422.

Experimentation on prototypes of PEC components is presently being carried out at Casaccia CRE. This report shows the results of the first cycle of experimentation of the central channel, concerning the aspects of sodium removal after experimentation.

25602 (ENEA-RT-VEL—84-7) **Regeneration of the cold trap of the PEC mechanism testing plant. Design criteria.** Caponetti, R.; Petrazzuolo, F. (ENEA, Rome (Italy)). 1984. 71p. (In Italian). NTIS (US Sales Only), PC A04/MF A01. File Number DE86701423.

Experimentation on prototypes of PEC reactor blocking mechanisms is presently in course at Casaccia Cre in the experimental engineering division of the fast reactor department. After a brief description of the experimental cycle of the components, this report shows the design criteria of a selected method for the regeneration of mechanism testing plant cold trap.

25603 (IAEA-TECDOC—344, pp 7-17) **Design features, development status and long term prospects of light water high conversion reactors.** Goetzmann, C.A.; Kuczera, B. (Kraftwerk Union A.G., Erlangen, Germany, F.R.; Kernforschungszentrum Karlsruhe G.m.b.H., Germany, F.R.). Sep 1985. NTIS (US Sales Only), PC A10/MF A01. File Number DE86701630. (CONF-8411237—).

From Technical committee and workshop on advanced light and heavy water reactor technology; Vienna, Austria (26 Nov 1984).

For some years long-term considerations on U-Pu fuel cycle strategies also include advanced LWR systems with tight lattice core configurations. In this context it is a well known fact that epithermal recycling is superior to thermal recycling in the sense that a higher amount of energy can be drawn from a given quantity of uranium ore on account of the higher conversion ratio associated with hard spectrum cores. Reducing the amount of water in the core of a standard PWR to the largest extent possible within the constraints of core cooling is the basic feature of the Light Water High Conversion Reactor (LWHCR). In order to obtain the desired conversion ratios about 0.9, the water-to-fuel-ratio has to be reduced from about two for normal PWR's to a value around 0.5 in an LWHCR-core. This tight lattice requires a new core design which has to be experimentally verified in the areas of neutron physics, stationary and transient thermohydraulics, core element mechanical design and core element technology. The main problem in neutron physics concerns the accurate prediction of the interconnected parameters conversion ratio, reactivity loss due to burnup and reactivity changes upon postulated coolant losses for spectral conditions that fall in between what is known from LWR and fast breeder analyses, respectively. The tight lattice requirement leads to core element designs that differ substantially from those typical for normal light water reactors. At the present time two different concepts, a so-called homogeneous variant and a heterogeneous version, respectively, are being investigated. In either case design and test work is necessary to decide questions such as what type of spacer is feasible, should the fuel element have a flow duct, how should fissile and fertile material be physically arranged within the core, what type of core support, control rods and drives should be selected and so on.

25604 (IAEA-TECDOC—344, pp 21-38) **Development strategy on advanced and future PWR.** Ogura, S.; Toyoda, Y.; Shimada, S.; Iwai, S. (Mitsubishi Heavy Industries Ltd., Tokyo, Japan; Mitsubishi Atomic Power Industries, Inc., Tokyo, Japan). Sep 1985. NTIS (US Sales Only), PC A10/MF A01. File Number DE86701630. (CONF-8411237—).

From Technical committee and workshop on advanced light and heavy water reactor technology; Vienna, Austria (26 Nov 1984).

Mitsubishi Heavy Industries, Ltd. (MHI), having considerable experiences of PWRs through the design and construction in Japan, has achieved the highest level of the PWR technology. Nowadays MHI's main intentions are on the reduction of construction costs. Prior to the times of FBR's, PWR should improve the economical efficiency in the view of world resources strategy. MHI is developing APWR-Japan consistent with PWR, which has a spectral shift reactor, in cooperation with Westinghouse Electric Corporation. MHI establishes that electricity unit cost can be reduced about 20%, as compared with the conventional PWR's, by virtue of APWR-J's prolongation of the fuel cycle and improvement of that reactor. However, as the commercial operation of FBR appears to be realized much later than the first expectation, MHI decides to develop the next reactor concept between APWR and FBR. HCPWR is capable of increasing the conversion ratio (CR) up to about 0.9, therefore, HCPWR spends less plutonium and is available for usage of uranium resources. Merits of HCPWR are technically to achieve high CR and high burn-up that require reducing the volume ratio of moderator to fuel, and to enrich plutonium concentration. These requirements cause the temperature coefficient and void reactivity to move to the more positive side which may bring essential problems in safety. In view of thermal-hydraulic characteristics, high CR means less coolant flow cross section area in the reactor core. This results in reduction of power generation because of reduction of the primary coolant flow due to the higher flow resistance and reduction of the critical heat flux due to narrower flow paths. CR is determined by the volume ratio of moderator to fuel, and its achievable value has the possibility of further study in relation to plutonium strategy in Japan.

25605 (IAEA-TECDOC—344, pp 38-43) **CEA experimental program for validating the tight lattice reactor concept.** Barre, B. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-les-Durance, France). Sep 1985. NTIS (US Sales Only), PC A10/MF A01. File Number DE86701630. (CONF-8411237—).

From Technical committee and workshop on advanced light and heavy water reactor technology; Vienna, Austria (26 Nov 1984).

The paper contains a description of the incentives for the CEA programme on the tight lattice reactor concept and a description of the programme itself. Besides aspects of neutron analysis calculations, the critical experiment ERASME and the irradiation facility within the MELUSINE reactor are described. In addition the paper contains a review of the thermal hydraulic experimental programme and of the improvements that are necessary in the theoretical methods.

25606 (IAEA-TECDOC—344, pp 43-46) **FRAMATOME studies on high conversion water reactor concept.** Millot, J.P. (Societe Franco-Americaine de Constructions Atomiques, FRAMATOME, 92 - Courbevoie, France). Sep 1985. NTIS (US Sales Only), PC A10/MF A01. File Number DE86701630. (CONF-8411237—).

From Technical committee and workshop on advanced light and heavy water reactor technology; Vienna, Austria (26 Nov 1984).

A few years ago, a preliminary study on the advantages of tight lattice reactors was launched. This study enabled us to evaluate the order of magnitude of the conversion ratio and of the KWh

cost which could be reached with such reactors, and to have a first glance on the problems in the design and the safety which would be met with it. This evaluation was based on a 1300 MWe reactor with a fuel assembly very close to that of the FBRs: the wire wrapped rods had a stainless steel cladding and the bundle was enclosed in a hexagonal box; the moderation ratio was 0.5. We considered two new fuel designs with spacer grids: a) a fuel with stainless steel cladding: due to the reactivity gain obtained with the removal of the hexagonal box, the conversion ratio can be kept the same as before with a moderation ratio of 0.6 and an initial enrichment in plutonium of 8.5%. b) a fuel with Zircaloy cladding: in the same conditions, the moderation ratio is 0.7 and the initial enrichment 7.2%. In order to solve these difficulties we considered a fuel assembly with spacer grids and with a higher moderation ratio, around 1.1.; the unavoidable loss in the conversion ratio is compensated by the benefit of the mechanical spectral shift produced by fertile rod cluster assemblies. The distance between adjacent fuel rods is approximately the same as in a standard PWR, and therefore the risks of blockage in case of a LOCA are eliminated. The initial enrichment is 5%. At present our studies are still under way in order to determine if other problems will have to be taken into account or not in the design and the safety of these reactors. In other respects, the spectral shift reactor would present another advantage: it is contemplated that it accept either plutonium or uranium cores, with the possibility of shifting from one to the other during a reloading operation.

25607 (IAEA-TECDOC—344, pp 47-55) **Swiss R and D efforts on the LWHCR concept.** Brogli, R.; Chawla, R.; Jermann, M.; Varadi, G. (Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen, Switzerland). Sep 1985. NTIS (US Sales Only), PC A10/MF A01. File Number DE86701630. (CONF-8411237—).

From Technical committee and workshop on advanced light and heavy water reactor technology; Vienna, Austria (26 Nov 1984).

An important measure which leads to improved fuel utilization in thermal reactors is to increase the conversion ratio. With light water reactors continuing to dominate the nuclear energy scene, a concept that has been receiving increasing attention is that of the Light Water High Convertor Reactor (LWHCR), involving the use of PuO_2/UO_2-fueled tight-pitch lattices in standard PWRs. The Swiss Federal Institute for Reactor Research (EIR) started early in 1980 with a program of reactor physics experiments on LWHCR lattices in its zero-energy reactor facility PROTEUS at Wuerenlingen. Parallel to the experimental program a technical feasibility study on the potential of LWHCRs was carried out, in which a range of LWHCR designs with different fuel-to-moderator ratios was considered. A second phase of LWHCR physics experiments in PROTEUS has been under planning for being carried out during 1985-89. Another area in which EIR intends to initiate experimental activity is that related to LOCA thermohydraulics. Thus, design calculations and construction work have been under way to enable reflooding experiments to be performed in the NEPTUN facility using a 37-rod tight-lattic geometry bundle. A special series of single-channel experiments is also being planned in parallel.

25608 (IAEA-TECDOC—344, pp 84-91) **Burnup characteristics of a tight lattice high converting PWR.** Berger, H.D.; Oldekop, W.; Zeggel, W. (Technische Univ. Braunschweig, Germany, F.R. Lehrstuhl fuer Raumflugtechnik und Reaktortechnik). Sep 1985. NTIS (US Sales Only), PC A10/MF A01. File Number DE86701630. (CONF-8411237—).

From Technical committee and workshop on advanced light and heavy water reactor technology; Vienna, Austria (26 Nov 1984).

One measure to improve fuel utilization in light water reactors is to increase their conversion ratio. Such high converting light water reactors (LWHCR), mainly advanced pressurized water reactors, have been investigated in Europe and the United States for several years. PWR-related R and D activities at the Technical University of Braunschweig, FRG, started in 1978. This paper deals with some of the burnup characteristics of a homogeneous LWHCR-design with an F/M-ratio of 1.9. As a consequence of the high conversion ratio the reactivity change with burnup is very flat as compared to that for conventional PWRs. The reactivity loss during burnup is caused predominantly by fission-product absorptions, with the relatively low consumption of fissile material being of minor importance. A breakdown of the so-called burnup coefficient, which is a direct measure of the reactivity change with exposure, enables a quantitative discussion of the influence of individual nuclides. The changes in fuel isotopic composition during burnup are characterized by: the decrease of the Pu 239 and Pu 242 content of the fuel and, depending upon their initial concentrations, a slight or moderate increase of Pu 240 and Pu 241. The Pu 239 losses exceed the Pu 241 production, i.e. the plutonium quality, defined as the fraction of fissile isotopes in the Pu, decreases. This decline of plutonium quality is, however, small (e.g. 0.653 at the end of equilibrium cycle (45 MWd/kgsub(HM)) related to 0.673 at BOL), and, from the viewpoint of neutron economy, partly compensated for by a more favourable Pu 241/Pu 239 ratio. The above characteristics of high converting pressurized water reactors, viz. the low net consumption of fissile material as well as the conservation of plutonium quality, confirm that such reactors can be effective in helping to stretch the fissile resources.

25609 (INIS-BR—419, pp 331-343) **Recent development of a CEC'S elasto-plastic-creep cyclic benchmark programme relevant to LMFBR structural integrity.** Corsi, F.; Terzaghi, A. (ENEA, Casaccia, Italy; Commission of the European Communities, Brussels, Belgium). 1984. NTIS (US Sales Only), PC A18/MF A01. File Number DE86701405. (CONF-8410303—Vol.3).

From Conference on structural analysis and design of nuclear power plant; Porto Alegre, Brazil (3 Oct 1984).

The programme is presented of elasto-plastic benchmark calculations relevant to LMFBr, which started in 1977 with the support and coordination of the Commission of the European Communities (CEC) and the participation of nuclear engineering and manufacturing companies as well as nuclear research centers of France, Germany, Italy and the United Kingdom.

25610 **(IWGFR—51) LMFBR plant parameters.** (International Atomic Energy Agency, Vienna (Austria). International Working Group on Fast Reactors). Jul 1985. 178p. NTIS (US Sales Only), PC A09/MF A01. File Number DE86701424.

This document has been prepared on the basis of information compiled by the members of the IAEA International Working Group on Fast Reactors (IWGFR). It contains parameters of 25 experimental, prototype and commercial size liquid metal fast breeder reactors (LMFBR). Most of the reactors are currently in operation, under construction or in an advanced planning stage. Parameters of the Clinch River Breeder Reactor (USA) are presented because its design was nearly finished and most of the components were fabricated at the time when the project was terminated. Three reactors (RAPSODIE (France), DFR (UK) and EFFBR (USA)) have been shut down. However, they are included in the report because of their important role in the development of LMFBR technology from first LMFBRs to the prototype size fast reactors. The first LMFBRs (CLEMENTINE (USA), EBR-1 (USA), BR-2 (USSR), BR-5 (USSR)) and very special reactors (LAMPRE (USA), SEFOR (USA)) were not recommended by the members of the IWGFR to be included in the report.

25611 **Liquid uranium alloy-helium fission reactor.** Minkov, V. (to Dept. of Energy). US Patent 4,563,327. 7 Jan 1986. Filed date 13 Jun 1984. vp.

This patent describes a nuclear fission reactor, consisting of a core vessel and a heat exchanger and passage coupling the vessels together at their respective upper and lower ends to define a continuous loop for the unidirectional flow of a liquid through the vessels. It also consists of: means for supporting and moving control elements adjustably within the core vessel in order to vary their relative position therein; fissionable fuel confined in the liquid phase in the vessels at a depth up to the upper passage; a lattice of a poison or moderator material in the passages and in the heat transfer vessel to preclude any fission within; means to admit a heat transfer gas into the lower end of the heat exchanger vessel, the gas bubbling through the liquid therein and causing the liquid to circulate upward in the heat exchanger vessel and downward in the

cooled core vessel; and means to direct the heat transfer gas from the upper end of the heat exchanger vessel to conventional energy means outside of the reactor heat exchanger vessel.

2107 Regulation And Licensing

REFER ALSO TO CITATION(S) 25687

25612 **(GAO/RCED—86-27) Nuclear regulation. Process for backfitting changes in nuclear plants has improved.** Bowsher, C.A. (General Accounting Office, Washington, DC (USA). Office of the Comptroller General). Dec 1985. 80p. General Accounting Office, Box 6015, Gaithersburg, MD 20877. File Number TI86901166.

Report to the Congress.

This report examines the process used by the Nuclear Regulatory Commission to require modifications at operating nuclear power plants, the effect of those actions on selected facilities, and improvements that should be made.

25613 **(NUREG/CR—4436-Vol.1) Human reliability impact on inservice inspection. Phase 1, summary report. Volume 1.** Spanner, J.C.; Badalamente, R.V.; Rankin, W.L.; Triggs, T.J. (Pacific Northwest Labs., Richland, WA (USA); Battelle Human Affairs Research Center, Seattle, WA (USA)). Mar 1986. Contract AC06-76RL01830. 113p. (PNL—5641-Vol.1; BHARC—400/85/016-Vol.1). NTIS, PC A06/MF A01 - GPO. File Number TI86008834.

This report documents a feasibility study conducted to identify, characterize, and evaluate the human reliability aspects of ultrasonic testing/inservice inspection (UT/ISI). During this study, the following four inter-dependent tasks were completed: (1) perform a literature survey to identify significant human performance factors and develop a better measure of performance for the UT/ISI process, (2) develop task element descriptions for a typical UT/ISI process, (3) prepare a test plan to conduct a human performance evaluation in conjunction with a mini-round robin study, and (4) prepare a project plant for conducting the needed follow-on work identified during the feasibility study. This report includes an assessment of UT applications in the nuclear industry, emphasizing the UT/ISI system (personnel, equipment, and procedures). A man-machine systems model is used to describe the UT/ISi process, and the Relative Operating Charcteristic (ROC) analysis approach for analyzing NDT performance is discussed. The five basic performance-shaping factors (variables) are evaluated with respect to potential impact on UT/ISI performance. Conclusions are drawn based on this limited scope study, and recommendations are made for needed folow-on work toward improving UT/ISI reliability.

25614 **(NUREG/CR—4446) Nuclear industry and its regulators: a new compact is needed.** (International Energy Associates Ltd., Washington, DC (USA)). Feb 1986. 103p. (IEAL-R—85-70). NTIS, PC A06/MF A01. File Number TI86900890.

The problem of the lack of integration in the nuclear power decision-making process in the United States is the subject of this study. The three institutions with the greatest influence on commercial nuclear power generation include the utilities, the Nuclear Regulatory Commission (NRC) and the state public utility commissions (PUCs). The diverse objectives of the three institutions are difficult to satisfy without producing conflict. This has contributed to inefficiencies and delays in nuclear plant construction and operation, gaps in quality assurance, and may also result in compromises to public health and safety. This report reviews the perspectives of each of these institutions and provides recommendations for improvements. Particular emphasis is given to recommendations that NRC might consider to help alleviate the potential for adverse impacts on public health and safety resulting from a disaggregated nuclear power decision-making process.

25615 **(PB—86-147550/XAB) Nuclear power in an age of uncertainty. Volume 2--working papers. Part 2.** (Office of Technology Assessment (U.S. Congress), Washington, DC). Nov 1984. 274p. NTIS, PC A12/MF A01.

Papers included are: Issues affecting the viability and acceptability of nuclear power usage in the United States; The future of conventional nuclear power: nuclear reactor regulation; Nuclear reactor regulation and nuclear reactor safety; Case studies on regulatory requirements.

2108 Economics

REFER ALSO TO CITATION(S) 25563, 25589, 25595, 25658, 25659, 25660, 25661

25616 **(NRCN—555) Fusion-fission hybrid reactors and nonproliferation.** Greenspan, E. (Israel Atomic Energy Commission, Beersheba. Nuclear Research Center-Negev). Sep 1984. 106p. NTIS (US Sales Only), PC A06/MF A01. File Number DE86701520.

New options for the development of the nuclear energy economy which might become available by a successful development of fusion-breeders or fusion-fission hybrid power reactors, are identified and their nonproliferative attributes are discussed. The more promising proliferation-resistance attributes identified include: (1) Justification for a significant delay in the initiation of fuel processing, (2) Denaturing the plutonium with ^{238}Pu before its use in power reactors of any kind, and (3) Making practical the development of denatured uranium fuel cycles and, in particular, denaturing the uranium with ^{232}U. Fuel resource utilization, time-table and economic considerations associated with the use of fusion-breeders are also discussed. It is concluded that hybrid reactors may enable developing a nuclear energy economy which is more proliferation resistant than possible otherwise, while at the same time, assuring high utilization of the uranium and thorium resources in an economically acceptable way.

25617 **(PB—86-147543/XAB) Nuclear power in an age of uncertainty. Volume 2--working papers. Part 1.** (Office of Technology Assessment (U.S. Congress), Washington, DC). Nov 1984. 273p. NTIS, PC A12/MF A01.

Papers included are: Reliability of nuclear power plant hardware: past performance and future trends; Reactor quality: Factors affecting managerial and institutional competence of utility nuclear operations; Survey and assessment of the technological options available to the nuclear industry in the 1980 to 2000 period; Nuclear power plant size: dependent characteristics.

25618 **(PB—86-147568/XAB) Nuclear power in an age of uncertainty. Volume 2--working papers. Part 3.** (Office of Technology Assessment (U.S. Congress), Washington, DC). Nov 1984. 219p. NTIS, PC A10/MF A01.

Papers included are: An assessment of institutional alternatives for nuclear power generation; Effects on the nuclear industry of no-new plant order, 1985-2000; Survey of major national groups influencing public opinion against nuclear power; Activities of groups which influence public opinion in favor of nuclear power.

22 NUCLEAR REACTOR TECHNOLOGY

REFER ALSO TO CITATION(S) 26548

25619 **(NP—6900946) Institute for Nuclear Study. Annual report 1982, January 1982-December 1982.** (Tokyo Univ. (Japan). Inst. for Nuclear Study). 1982. 157p. NTIS (US Sales Only), PC A08/MF A01. File Number DE86900946.

This report describes the work of the Institute for Nuclear Study (INS) during the calendar year 1982. Studies of nuclear structure and nuclear reaction have been pursued mainly by use of the SF cyclotron, at the Low-Energy Physics Division. Studies on photoreaction have been continued by use of the 1.3-GeV electron synchrotron, at the High-Energy Physics Division. The INS-LBL collaboration program on the Bevalac experiment has been continued to study high-energy nucleus-nucleus collisions. A test RFQ linac, LITL, has been constructed and successfully accelerated ion beams, at the study group for Numatron Project, thus demonstrating that the use of RFQ linac is effective to accelerate low-velocity heavy ions. The computer facilities at the Institute have been made a reinforcement in the fall of this year: The system consists of two

main computers, type FACOM M-180 II AD, with the memory of 4 MB x 16. The speed of cpu has been improved to 4.2 MIPS from 2.5 MIPS, with the speed-up factor of around 2.5 in the double precision calculation. A laser printer and a color graphic display have also been installed. The Institute has continued to play a role in organizing various symposia and workshops as a center of research activities. The 10th INS international symposium was held on "Dynamics of Nuclear Collective Motion - High Spin States and Transitional Nuclei", at the foot of Mt. Fuji, on July 6-10, 1982, organized by the Theoretical Physics Division. The symposium was successful and the number of participants was 124, among them 51 from 13 foreign countries. The 3rd INS-Kikuchi Summer School was held on "Recent Topics on Nuclear Structure" at Dogashima on July 2-5, 1982, organized by the Low-Energy Physics Division.

2201 Theory And Calculation

REFER ALSO TO CITATION(S) 26788

25620 **(CTA-IEAV-NT—05/85) Sensitivity profiles calculated with the UNISENS system.** Claro, L.H.; Menezes, A. (Centro Tecnico Aeroespacial, Sao Jose dos Campos (Brazil). Inst. de Estudos Avancados). 1985. 124p. (In Portuguese). NTIS (US Sales Only), PC A06/MF A01. File Number DE86701625.

Sensitivity profiles of the multiplication factor and several central reaction ratios for benchmarks ZPR 6/7, ZPR 3/11, FLAT-TOP-25, GODIVA and BIG-TEN, are presented in grafic form. A possible utilization is showed through some modification to the ENDF/B-IV data file proposed for version ENDF/B-V.

25621 **(KFKI—1985-67) Damped resonances in the neutron power spectra in coupled multivariable reactor dynamical models.** Mesko, L. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). Jul 1985. 14p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701626.

A new kind of reactor noise resonances is discussed. In contradiction to the known cases, where the resonances originate from vibration of structural elements or from linear oscillations due to the coupled thermohydraulic and neutron kinetic effects, the new kind of resonances might be signs at hidden internal positive feedback processes. A point model and its distributed parameter version is presented to show that the feedback effect is caused by the forced convection of the coolant. These sharp resonance peaks may be very important concerning the reactor stability and diagnostics.

25622 **(KFKI—1985-69) Studies to the stochastic theory of the coupled reactor kinetic-thermohydraulic systems. Pt. 5. Calculated CPSDs between in-core neutron and core-exit temperature detectors.** Kozma, R. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). Jul 1985. 9p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701627.

The behaviour of a coupled space-dependent reactor model was investigated earlier by the author. The detailed analysis of the system eigenvalues showed the effect of the low-frequency splitting of the eigenvalues. In the present paper the effect of this eigenvalue-splitting on the measurable physical quantities is investigated, i.e. neutron-temperature CPSDs calculated using the splitted eigenvalues are shown. In a very simple model the effect of the appearance of small void fraction in a PWR core is studied.

25623 **(UCRL—93773) On-line diagnosis and recovery of adversary attack using logic flowgraph methodology simulation.** Guarro, S.B. (Lawrence Livermore National Lab., CA (USA)). Jan 1986. Contract W-7405-ENG-48. 11p. (CONF-860359—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE86005090.

From Eastern simulation conference; Norfolk, VA, USA (10 Mar 1986).

The Logic Flowgraph Methodology (LFM) allows the construction of special graph models for simulation of complex processes of causality, including feedback loops and sequential effects. Among the most notable features of LFM is the formal inclusion in its models of causality conditioning by logic "switches" imbedded in the modeled process, such as faults or modes of operation. The LFM model of a process is a graph structure that captures, in one synthetic representation, the relevant success and fault space characterization of that process. LFM is very similar to an artificial intelligence "expert system shell." Besides providing the grammar and the syntax for the construction of process causality models, it in fact provides also a computer based "inference engine" for the automatic execution of reliability, diagnosis and recovery analyses from the constructed models. Because it encourages the user to derive comprehensive models of a process, LFM can be defined as a "model based" system, wheras most of the current generation expert systems are "rule" or "frame" based, and use heuristic, rather than causality driven, inference. 3 refs., 5 figs.

25624 **Projected discrete ordinates methods for numerical transport problems.** Larson, E.W. (Univ. of California, Los Alamos National Lab., Los Alamos, NM 87545). *Nuclear Science and Engineering;* **92**: No. 2, vp(Feb 1986).

A class of "projected discrete ordinates" (PDO) methods is described for obtaining iterative solutions of discrete ordinates problems with convergence rates comparable to those observed using diffusion synthetic acceleration (DSA). The spatially discretized PDO solutions are generally not equal to the DSA solutions, but unlike DSA, which requires great care in the choice of spatial discretizations to preserve stability, the PDO solutions remain stable and rapidly convergent with essentially arbitrary spatial discretizations. Numerical results are presented that illustrate the rapid convergence and the accuracy of solutions obtained using PDO methods with commonplace differencing methods.

25625 **Nonlinear diffusion synthetic acceleration difference schemes for radiative transfer applications.** Clark, B.A. (Los Alamos National Lab., Applied Theoretical Physics Div., Los Alamos, NM 87545). *Nuclear Science and Engineering;* **92**: No. 2, vp(Feb 1986).

A new three-point nonlinear difference scheme for diffusion synthetic acceleration (DSA) of the radiation transport equation is described. The new scheme is compared with the standard one-point method on two test problems. In addition, the two DSA methods are used to accelerate a variety of discrete ordinates difference schemes. The methods are very effective in accelerating the convergence of the transport iteration. Each of the DSA methods is accelerated by grey, or one-group, diffusion acceleration equation, which is also successful in increasing efficiency. The new method is at least 50% faster than one-point DSA method and this advantage increases with the difficulty of the problem and with tighter convergence criteria. The new acceleration method reduces computer time by at least one order of magnitude compared to unaccelerated calculations.

25626 **Augmented weighted-diamond form of the linear-nodal scheme for Cartesian coordinate systems.** Walters, W.F. (Los Alamos National Lab., Radiation Transport Group, P.O. Box 1663, Los Alamos, NM 87545). *Nuclear Science and Engineering;* **92**: No. 2, vp(Feb 1986).

The equations of the high-order linear-nodal numerical scheme are cast in an augmented weighted-difference form for three-dimensional Cartesian nodes. The coupling exhibited by these equations indicates that this new algorithm is simpler and, hence, faster than previous nodal schemes of this degree of accuracy. A well-logging problem and a fast reactor problem are examined. The new scheme developed is compared with the classical linear-linear nodal scheme and the diamond-difference scheme. For the well-logging problem, it is found that the new scheme is both faster and simpler than the classical linear-linear nodal scheme while sacrificing little in accuracy. Even though the new scheme is more accurate than the diamond-difference scheme for the reactor problem, the results indicate that state-of-the-art acceleration methods are needed for nodal schemes.

25627 **The DC/sub N-SN/ hybrid method for neutron transport calculations in (r-z) geometry.** Watanabe, Y.; Maynard, C.W. (University of Wisconsin, Fusion Technology Institute, 1500 Johnson Drive, Madison, WI 53706). *Nuclear Science and Engineering;* **92**: No. 2, vp(Feb 1986).

A hybrid method for two-dimensional neutron transport calculations in (r-z) geometry has been developed. In this method the equation in void regions is solved by the discrete cones (DC/sub N/) method, whereas the equation in nonvoid regions is solved by the standard discrete ordinates (S/sub N/) method. The two methods are incorporated in one computer program so that a user does not see the difference from a program applying only the S/sub N/ method. This DC/sub N-SN/ hybrid method significantly mitigates the ray effects in a void compared with a solution by the same order S/sub N/. The method, however, requires a little more computing effort and it is difficult for the method to yield a sufficiently accurate solution for narrow duct streaming problems.

25628 **Monte Carlo techniques for analyzing deep-penetration problems.** Cramer, S.N.; Gonnord, J.; Hendricks, J.S. (Oak Ridge National Laboratory, Oak Ridge, TN 37831). *Nuclear Science and Engineering;* **92**: No. 2, vp(Feb 1986).

Current methods and difficulties in Monte Carlo deep-penetration calculations are reviewed, including statistical uncertainty and recent adjoint optimization of splitting, Russian roulette, and exponential transformation biasing. Other aspects of the random walk and estimation processes are covered, including the relatively new DXANG angular biasing technique. Specific items summarized are albedo scattering, Monte Carlo coupling techniques with discrete ordinates and other methods, adjoint solutions, and multigroup Monte Carlo. The topic of code-generated biasing parameters is presented, including the creation of adjoint importance functions from forward calculations. Finally, current and future work in the area of computer learning and artificial intelligence is discussed in connection with Monte Carlo applications.

25629 **Review of Monte Carlo techniques for analyzing reactor perturbations.** Rief, H.; Gelbard, E.M.; Schaefer, R.W.; Smith, K.S. (Commission of the European Communities, Joint Research Centre, 21020 Ispra (Va)). *Nuclear Science and Engineering;* **92**: No. 2, vp(Feb 1986).

Monte Carlo perturbation analysis has progressed considerably during recent years. Generalized schemes for correlated tracking and higher order derivative operator sampling have been elaborated for commonly used estimators. For special problems, like voiding of strongly absorbing regions, new solutions have been developed. Their respective advantages, especially in view of variance considerations, have been analyzed for simple models. Also, perturbations of eigenvalues could be determined by these methods, provided the usual source iteration procedure is coupled with adjoint weighting or replaced by the Green's function (fission matrix) approach.

25630 **Vectorization of transport and diffusion computations on the CDC Cyber 205.** Abu-Shumays, I.K. (Bettis Atomic Power Laboratory, P.O. Box 79, West Mifflin, PA 15122-0079). *Nuclear Science and Engineering;* **92**: No. 1, vp(Jan 1986). Contract AC11-76PN00014.

The development and testing of alternative numerical methods and computational algorithms specifically designed for the vectorization of transport and diffusion computations on a Control Data Corporation (CDC) Cyber 205 vector computer are described. Two solution methods for the discrete ordinates approximation to the transport equation are summarized and compared. Factors of 4 to 7 reduction in run times for certain large transport problems were achieved on a Cyber 205 as compared with run times on a CDC-7600. The solution of tridiagonal systems of linear equations, central to several efficient numerical methods for multidimensional diffusion computations and essential for fluid flow and other physics and engineering problems, is also dealt with. Among the methods tested, a combined odd-even cyclic reduction and modified Cholesky factorization algorithm for solving linear symmetric positive definite tridiagonal systems is found to be the most effective for these systems on a Cyber 205. For large tridiagonal systems, computation with this algorithm is an order of magnitude faster on a Cyber 205 than computation with the best algorithm for tridiagonal systems on a CDC-7600.

25631 **A linear discontinuous Galerkin approximation for the continuous slowing down operator.** Lazo, M.; Morel, J.E. (University of New Mexico, Department of Chemical and Nuclear Engineering, Albuquerque, NM 87131). *Nuclear Science and Engineering;* **92**: No. 1, vp(Jan 1986).

A linear discontinuous Galerkin treatment is developed for the continuous slowing down operator. Multigroup Legendre coefficients are derived that allow this treatment to be implemented in standard S/sub ETA/ codes. A synthetic acceleration scheme is developed to accelerate the outer iterations required by this treatment. A computational comparison between the diamond difference treatment and the linear discontinuous treatment is given.

2202 Components And Accessories

REFER ALSO TO CITATION(S) 25850, 26603

25632 **(EPRI-NP—4456) Steam generator tube denting. Field study.** Pyo, J.K. (Levy (S.), Inc., Campbell, CA (USA)). Mar 1986. 214p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI86920220.

This project attempted to utilize the large amount of steam generator field experience by correlating tube denting failures to water chemistry operation and steam generator design parameters. The data base consisted of detailed water chemistry by fuel cycle, detailed steam generator design and operational parameters, and tube failure data from numerous domestic and foreign operating plants. Data were collected for past operating histories from the start of all volatile water treatment through 1983. The field data were contrasted with laboratory results and were subjected to statistical analysis utilizing clustering algorithms, discrimination techniques, factor analysis and regression analysis. The view that chloride is a major contributor to denting in steam generators was supported by the data but other correlations were not found. Several deficiencies in the collected data base may have obscured correlation with existing tube denting theories. 51 figs., 16 tabs.

25633 (INIS-BR—419, pp 243-256) **Seismic analysis of secondary systems with multiple supports.** Burdisso, R.A.; Singh, M.P. (Virginia Polytechnic Inst. and State Univ., Blacksburg, USA. Dept. of Engineering Science and Mechanics). 1984. NTIS (US Sales Only), PC A18/MF A01. File Number DE86701405. (CONF-8410303—Vol.3).

From Conference on structural analysis and design of nuclear power plant; Porto Alegre, Brazil (3 Oct 1984).

An analytical formulation for seismic analysis of multiple connected secondary systems is presented. The formulation leads to the development of a new response spectrum aproach for the analysis of secondary systems. The seismic input in this approach is required to be defined in terms of auto and cross pseudo-acceleration and relative velocity floor response spectra. The cross spectra comprise of the coincident and quadrature spectra for pseudo-acceleration and relative velocity response of an oscillator. By the analysis of the supporting primary structure, these auto and cross spectra can be directly obtained from the ground response spectra. An effective use of these spectra for the calculation of secondary system response is demonstrated by a numerical example.

25634 (INIS-BR—419, pp 257-289) **On the choice of linear dynamic analysis methods for substructure design problems.** Leimbach, K.R.; Krutzik, N.J. (Bochum, Germany, F.R.; Kraftwerk Union A.G., Offenbach am Main, Germany, F.R.). 1984. NTIS (US Sales Only), PC A18/MF A01. File Number DE86701405. (CONF-8410303—Vol.3).

From Conference on structural analysis and design of nuclear power plant; Porto Alegre, Brazil (3 Oct 1984).

The paper starts with a dynamic substructure formulation of coupled modal equations using main structure and substructure modes. By reducing the vector space to pairs of main structure and substructure modes an approximation is obtained from which a generalized response spectrum method and a corresponding automated numerical scheme can be derived. From the general set of equations the traditional approximations are derived. The numerical treatment of subsystems using support displacements instead of accelerations is being explored. Two effects additional to the modal

response contributions are considered: the secondary effects of out-of-phase motion of the supports which are treated by static analysis and the correction of truncation error of the modal analysis, also approximated by a quasi-static analysis. Special attention is focussed on the selection of super-position methods for the various contributions.

25635 (INIS-BR—419, pp 291-315) **Non linear dynamic analysis of piping systems under impulsive loadings.** Hoffmann, A.; Millard, A.; Livolant, M. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette, France. Dept. d'Etudes Mecaniques et Thermiques). 1984. NTIS (US Sales Only), PC A18/MF A01. File Number DE86701405. (CONF-8410303—Vol.3).

From Conference on structural analysis and design of nuclear power plant; Porto Alegre, Brazil (3 Oct 1984).

The importance of piping systems in power industries and especially in nuclear power plants is well established. In view of safety requirements, the behaviour of these piping systems in case of faulted conditions must be studied. In particular, impulsive loading like impacts on pipes or post rupture dynamics pipe behaviour are considered. The aim of this paper is to enlighten the difficulties and features associated with such loadings and to present methods of solution using different finite element codes. Two applications to real problems will be presented.

25636 (INIS-BR—419, pp 317-330) **State of the art of pipe clamp analysis.** Fang, P.J. (NATRON-Consultoria e Projetos S/A, Rio de Janeiro, Brazil). 1984. NTIS (US Sales Only), PC A18/MF A01. File Number DE86701405. (CONF-8410303—Vol.3).

From Conference on structural analysis and design of nuclear power plant; Porto Alegre, Brazil (3 Oct 1984).

Various types of clamps are used as a component of piping support structures in nuclear power plants. The clamp is referred to as a nonintegral attachment to pipe in contrast to lugs which are integrally welded to the pipe wall. An analysis to determine the load capacity of a clamp is complicated by the fact that the distribution of contact stresses acting on the clamp-pipe interface is a nonlinearly dependent on the geometry of the clamp and pipe, clamping force preapplied to the clamp, and external loads. This paper reviews various methods of clamp analysis including both the closed-formed solutions and the finite element approach. While conventional two- and three-bolt clamps for a horizontal pipe run are emphasized, stiff clamps and riser clamps are also discussed. Finally, the potential effects of interaction between the clamp and pipe are evaluated.

25637 (INIS-BR—419, pp 383-404) **Experimental and theoretical studies on the impact of deformable projectiles on RC slabs.** Ruediger, E.; Riech, H. (Hochtief A.G. fuer Hoch- und Tiefbauten, Frankfurt am Main, Germany, F.R.). 1984. NTIS (US Sales Only), PC A18/MF A01. File Number DE86701405. (CONF-8410303—Vol.3).

From Conference on structural analysis and design of nuclear power plant; Porto Alegre, Brazil (3 Oct 1984).

To get further information on the treatment of the loading case aircraft crash large scale tests with soft missiles have been executed at Meppen test site. These tests and the methods used for the test evaluation are described. It is shown that the impact behaviour of soft missiles can be accurately described with a modified RIERA model. Pre- and post calculations of the tests were made using the analytical methods of NPP design. The results of these calculations agreed well with the corresponding measurements.

25638 **(INIS-mf—10069) Hermetic cable penetrations for containments of nuclear power reactors meet high safety standards.** Kusserow, J.; Gurr, W.; Pflug, H. (VEB Kombinat Automatisierungsanlagenbau, Dresden (German Democratic Republic)). May 1985. 3p. (In German). NTIS (US Sales Only), PC A02/MF A01. File Number DE86701628.

Published in 'VEM Technische Informationen - Automatisierungsanlagen - Elektroenergieanlagen' no. 6 (May 1985) p. 34-36.

Different types of cable penetrations for containments of nuclear power reactors have been developed and fabricated in the GDR. The technical parameters achieved are in accordance with the radiation protection requirements.

25639 **(ORNL—5842) High temperature aqueous potassium and sodium phosphate solutions: two-liquid-phase boundaries and critical phenomena, 275-400°C; potential applications for steam generators.** Marshall, W.L. (Oak Ridge National Lab., TN (USA)). Dec 1981. Contract AC05-84OR21400. 23p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86009205.

Two-liquid-phase boundaries at temperatures between 275 and 400°C were determined for potassium phosphate and sodium phosphate aqueous solutions for compositions from 0 to 60 wt % dissolved salt. The stoichiometric mole ratios, K/PO_4 or Na/PO_4, were varied from 1.00 to 2.12 and from 1.00 to 2.16 for the potassium and sodium systems, respectively. Liquid-vapor critical temperatures were also determined for most of the dilute liquid phases that formed. The minimum temperatures (below which a single solution existed) of two-liquid-phase formation were 360°C for the potassium system and 279°C for the sodium system at mole ratios of 2.00 and 2.16, respectively. For the sodium system at mole ratios greater than 2.16, solids crystallized at lower temperatures as expected from earlier studies. In contrast, potassium solutions that were explored at mole ratios from 2.12 to 3.16 and at temperatures below 360°C did not produce solid phases nor liquid-liquid immiscibilities. Aside from the generally unusual observations of two immiscible liquids in an aqueous inorganic salt system, the results could possibly be applied to the use of phosphate additives in steam power generators. 16 refs.

2203 Fuel Elements

25640 **(ENEA-RT-COMB—84-9) Experience with a uranyl nitrate/uranium dioxide conversion pilot plant.** Arcuri, L.; Pietrelli, L.; Rizzello, C. (ENEA, Rome (Italy)). 1984. 45p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86701629.

A plant for the precipitation of sinterable nuclear grade UO_2 powders is described in this report. The plant has been designed, built and set up by SNIA TECHINT. ENEA has been involved in the job as nuclear consultant. Main process steps are: dissolution of UO_2 powder or sintered UO_2 pellets, adjustment of uranyl nitrate solutions, precipitation of uranium peroxide by means of hydrogen peroxide, centrifugation of the precipitate, drying, calcination and reduction to uranium dioxide. The report is divided in two main sections: the process description and the "hot test" report. Some laboratory data on precipitation of ammonium diuranate by means of NH_4OH, are also reported.

25641 **(INER—0586) FRAPCON-2 predictions of the fuel centerline temperatures in IFA-431 and IFA-432 assemblies.** Tseng, C.C.; Huang, K.Y. (Institute of Nuclear Energy Research, Lung-Tan (Taiwan)). Jun 1985. 46p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86901040.

Fuel centerline temperatures calculated by FRAPCON-2 fuel performance modeling code had been benchmarked with in-fuel thermocouple measurements of IFA-431 and IFA-432 which were irradiated at the Halden Boiling Water Reactor. Of the three mechanical models provided in FRAPCON-2, FRACAS-2 model appeared to be the best model. A comparison of FRACAS-2 output with the in-reactor measured data showed reasonable agreement. The overall mean error was -7.4% with a standard deviation of 12.2% at the lower thermocouple location. The overall mean error was 1.8% with a standard deviation of 7.7% at the upper thermocouple location.

25642 (IWGFPT—13, pp 301-310) **Oxide behaviour modelling progress in COMETHE.** Vliet, J. van; Hoppe, N. (Societe Belge pour l'Industrie Nucleaire, Brussels). Mar 1983. NTIS (US Sales Only), PC A99/MF A01. File Number DE84900984. (CONF-820360—).

From IAEA specialists meeting on water reactor fuel element performance computer modelling; Preston, UK (15 Mar 1982).

An attempt has been made to develop a global model which simultaneously describes many important aspects of uranium oxide under irradiation. The individual models describing fuel structural changes, swelling and gas release, which were earlier separate from one another, are now part of a more realistic integral fuel model. Fission gas release depends now on an explicitly calculated open porosity, which is generated by fuel swelling; the latter is in turn connected to fission gas release. The paper describes the individual oxide models and how they are linked together.

25643 (IWGFPT—13, pp 311-325) **TEMPER subcode system for transient temperature calculation in fuel elements.** Lassmann, K.; Preusser, T. (Kernforschungszentrum Karlsruhe G.m.b.H., Germany, F.R.; Technische Hochschule Darmstadt, Germany, F.R. Fachgebiet Reaktortechnik). Mar 1983. NTIS (US Sales Only), PC A99/MF A01. File Number DE84900984. (CONF-820360—).

From IAEA specialists meeting on water reactor fuel element performance computer modelling; Preston, UK (15 Mar 1982).

For the specific purpose of calculating temperatures in fuel element structural analysis, an advanced method has been developed. Fuel, cladding, coolant and structural temperatures are treated by a single system of equations. Melting of fuel and cladding and boiling of the coolant are considered. The method is compared to other solution techniques which are briefly reviewed. A comparison of thermal characteristics of finite element (FEM) and finite difference (FDM) transient calculations is presented. The present method includes FDM and FEM algorithms as special cases; an optimum combination of both techniques is the standard usage. Explicit, implicit or Crank-Nicholson integration procedures are possible. The method is fast running, reliable, and has no stability problems. The new method has been implemented into the temperature calculation subcode-system TEMPER for use with URANUS or other fuel element codes. Special attention has been given to user requirements (e.g. an automatic timestep control). URANUS, with this subcode-system TEMPER, has been applied successfully to difficult fast breeder fuel rod analyses including TOP, LOF, local coolant blockage and specific carbide fuel experiments.

25644 (IWGFPT—13, pp 327-341) **Parametric study of gas release fractions predicted by the MINIPAT D code and a comparison with a more advanced model, CORES.** Martin, D.G.; Harrison, J.W. (UKAEA Atomic Energy Research Establishment, Harwell. Metallurgy Div.). Mar 1983. NTIS (US Sales Only), PC A99/MF A01. File Number DE84900984. (CONF-820360—).

From IAEA specialists meeting on water reactor fuel element performance computer modelling; Preston, UK (15 Mar 1982).

The fission gas release code MINIPAT has been employed in a parametric survey to study the effect on gas release values, during the course of an isothermal irradiation, of varying the values of a number of items of input data. These include the initial grain size, diffusion coefficients, gas pressure, the extent of gas atom resolution from grain boundaries and the effect of a temperature step. The sensitivity of gas release values with variations in the diffusion coefficients is demonstrated. Gas releases decrease with increasing grain size, the quasi-equilibrium grain diameter attained during irradiation being the operative factor. Release values at constant temperature decrease with increasing rating; this is due to the interaction of a number of factors, which either increase or decrease the gas release. These results have been compared with some obtained from similar calculations, using another gas release model, CORES, which considers in greater detail the way gas is transferred from grain surfaces to the plenum. The reasonably good agreement obtained suggests that despite its simplicity, MINIPAT is able to predict with reasonable confidence gas release values from thermal reactor pins irradiated under normal operating conditions.

25645 (IWGFPT—13, pp 343-346) **Effect of axial diffusional delays on the overall fission gas release.** Kjaer-Pedersen, N. (Exxon Nuclear Co., Inc., Richland, WA, USA). Mar 1983. NTIS (US Sales Only), PC A99/MF A01. File Number DE84900984. (CONF-820360—).

From IAEA specialists meeting on water reactor fuel element performance computer modelling; Preston, UK (15 Mar 1982).

In fission gas release modelling, it is normally assumed that any locally released gas mixes instantly and perfectly with other gases throughout the internal rod void volume. The present work investigates the consequences of the assumption that perfect mixing is dependent on diffusion to occur, although the sub-assumption is maintained that pressure equilibrium is instantly achieved. In other words, when a burst of gas release occurs at any axial location, sufficient local accomodation takes place throughout the rod to eliminate any pressure gradients, but due to the narrowness of the passages through fuel cracks and fuel-cladding gap, concentration gradients may still prevail. Diffusion coefficients for the subsequent concentration equilibration are derived from classical theories. Application of one-dimensional diffusion theory is straightforward, but the lack of knowledge of the effective width of the axial passage introduces an uncertainty. If the assumption is made that the total cross-sectional void-area at any cross-section is available for diffusion through a straight, cylindrical duct, the theoretical exercise shows that the diffusional delay is unimportant, since equilibration will then happen at a faster rate than gas release. If, however, one takes account of the fact that the diffusion path is distorted due to the random positions of and surface mismatches between fuel fragments, the effective duct area is very much reduced, and the diffusional delay may turn out to be of great significance. This path distortion is modelled by multiplying the cross-sectional void area by a "constriction factor". The model has been implemented in a developmental performance code and benchmarked against power reactor and test reactor data. By carefully adjusting the constriction factor, it was possible to considerably improve the overall fit of the predicted gas release to the benchmarking data base.

25646 (IWGFPT—13, pp 347-358) **Model for predicting the radial power profile in a fuel pin.** Palmer, I.D.; Hesketh, K.W.; Jackson, P.A. (British Nuclear Fuels Ltd., Springfields Works, Preston). Mar 1983. NTIS (US Sales Only), PC A99/MF A01. File Number DE84900984. (CONF-820360—).

From IAEA specialists meeting on water reactor fuel element performance computer modelling; Preston, UK (15 Mar 1982).

A simple, fast running computer program for calculating radial power profiles, throughout life, in both standard and duplex fuel pellets for all types of thermal reactor has been developed. The code sub-divides the pellet into a number of annuli for each of which it solves for the concentrations of uranium and plutonium and hence calculates a mean inverse diffusion length. The diffusion equation is solved in terms of Bessel functions and the resulting flux profile multiplied by the concentration profiles to give a radial rating profile which is normalised to unity. The model shows good agreement with the results of detailed physics calculations for different thermal reactors over a wide burn-up range. Its incorporation into the HOTROD-4C and SLEUTH-SEER-77 fuel performance codes has led to a negligible increase in running times.

25647 (IWGFPT—13, pp 461-474) **Verification of FEMAXI-III code.** Okubo, T.; Ichikawa, M.; Ito, K.; Sogame, M.; Kinoshita, M.; Saito, H. (Faculty of Science and Technology, Sophia Univ., Japan; Division of Reactor Safety, Japan Atomic Energy Research Inst.; Nippon Nuclear Fuel Development Co., Ltd., Oarai, Ibaraki; Central Research Inst. of Electric Power Industry, Japan; Century Research Center Corp., Tokyo, Japan). Mar 1983. NTIS (US Sales Only), PC A99/MF A01. File Number DE84900984. (CONF-820360—).

From IAEA specialists meeting on water reactor fuel element performance computer modelling; Preston, UK (15 Mar 1982).

The verification results of the FEMAXI-III code were summarized and some sensitivity calculations were presented to show the general capability of the code. Basic agreement was obtained in the comparison with an extensive data base. Consistent results were shown in the sensitivity calculations on the irradiation parameters.

25648 (IWGFPT—13, pp 511-525) **Status of POSHO-THERMAL fuel performance model.** Rolstad, E.; Wennemo, S.E. (Scandpower A/S, Kjeller, Norway). Mar 1983. NTIS (US Sales Only), PC A99/MF A01. File Number DE84900984. (CONF-820360—).

From IAEA specialists meeting on water reactor fuel element performance computer modelling; Preston, UK (15 Mar 1982).

There are three main information sources that are useful for the determination of operation limits and strategies to prevent PCI failures in commercial reactors. (1) In-reactor experiments, specially performed to determine PCI failure limits. (2) Theoretical fuel performance codes. (3) Previous experience with similar fuel in commercial reactors. The interpretation of information sources (1) and (2) generally results in distinct thresholds, saying that the fuel will fail if the threshold is exceeded. Information source (3) has, however, shown that there is no sharp failure threshold, but a fairly wide regime with increasing probability for failure when the thresholds from sources (1) and (2) are approached. The PCI duty of the fuel would, in many reactors, extend far into the probabilistic failure regime and give unacceptably many failures if not special operation strategies had been developed to avoid this. A model that can predict the probability for failure when the PCI duty is less severe than the one giving certain failures is therefore urgently needed for effective use of present day reactors. POSHO-THERMAL is a model developed to predict the probability of fuel failures in commercial reactors. It is based approximately equally on all three information sources. Its calculations of fuel temperature, fission gas release, and clad strain have been compared and calibrated against information source (2). The high failure probability calculations have been compared and adjusted against information source (1), and the low probability calculations against information source (3). POSHO-THERMAL is a successor of POSHO. For the benefit of those unfamiliar with POSHO, a brief description is given of this program and the development that led to POSHO-THERMAL.

25649 (IWGFPT—13, pp 595-605) **Comparison with experiment of COMETHE III-L fuel rod behaviour predictions.** Vliet, J. van; Billaux, M. (Societe Belge pour l'Industrie Nucleaire, Brussels). Mar 1983. NTIS (US Sales Only), PC A99/MF A01. File Number DE84900984. (CONF-820360—).

From IAEA specialists meeting on water reactor fuel element performance computer modelling; Preston, UK (15 Mar 1982).

A comparison is presented between experimental results and COMETHE III-L fuel rod behaviour predictions. The first part of the paper focuses on mechanical aspects, with as main experiments, AECL X-264 and Studsvik Interramp. The second part presents the results of a wide FGR benchmarking campaign, with a reference to previous COMETHE versions. It appears that the variance between experiment and calculation has decreased by a factor four when the III-J version was improved into the III-L version. As conclusion, some COMETHE III-L calculations are presented in order to illustrate its capability of predicting fuel rod performance limits.

25650 (IWGFPT—13, pp 615-628) **Application of transient fuel bundle analysis code FRETA-B to LOCA simulation experiments.** Uchida, M.; Nakamura, J.; Otsubo, N. (Japan Atomic Energy Research Inst., Tokai, Ibaraki; Century Research Center Corp., Tokyo, Japan). Mar 1983. NTIS (US Sales Only), PC A99/MF A01. File Number DE84900984. (CONF-820360—).

From IAEA specialists meeting on water reactor fuel element performance computer modelling; Preston, UK (15 Mar 1982).

Fuel behavior during the loss-of-coolant-accident (LOCA) involves some two-dimensional phenomena in each elevation of a bundle arising from the unsymmetrical structure and also such stochastic factors as fuel relocation or uneven coolant flow. FRETA-B code can calculate heat conduction, deformation and oxidation of the cladding, and internal gas pressure and flow in multiple fuel rods of a bundle using two-dimensional models. Emphases are placed on the treatments of external (rod-to-rod, or rod-to-coolant) radiant heat transfer and ballooning of the cladding. Calculation can proceed beyond the time of rod-to-rod contact. To assess the code, analyses were performed on the ex-pile multi-rod ballooning experiment in JAERI and the in-pile LOCA simulation experiment in the NRU reactor. The simple and well-defined boundary condition of the ex-pile experiment has produced a good agreement between the calculation and the measurement of the cladding temperatures. The calculation on the in-pile experiment has shown that stochastic factors are dominant over structural ones in determining the distribution of the cladding temperature and deformation.

25651 (IWGFPT—13, pp 629-637) **COMETHE III-M for transient fuel rod behaviour prediction.** Billaux, M.; Vliet, J. van. (Societe Belge pour l'Industrie Nucleaire, Brussels). Mar 1983. NTIS (US Sales Only), PC A99/MF A01. File Number DE84900984. (CONF-820360—).

From IAEA specialists meeting on water reactor fuel element performance computer modelling; Preston, UK (15 Mar 1982).

The COMETHE III-M version is being developed in order to provide fuel rod behaviour prediction capability both in steady-state and in transient situations. It also allows to estimate the fuel rod enthalpy evolution versus time or burnup which may be important in correlated safety studies. This paper describes the transient heat transfer models, including transient heat conduction inside the fuel rod, and a subchannel model providing transient flow as well as enthalpy calculation capability. Transient fission gas release is also modelled on the basis of the change rate of oxide temperature. The models are illustrated by a few calculation examples.

25652 (IWGFPT—13, pp 659-670) **Fuel rod modelling under severe core damage conditions.** Bisanz, R.; Schmidt, F.A.; Ruehle, R.; Unger, H. (Stuttgart Univ., Germany, F.R. Inst. fuer Kernenergetik und Energiesysteme). Mar 1983. NTIS (US Sales Only), PC A99/MF A01. File Number DE84900984. (CONF-820360—).

From IAEA specialists meeting on water reactor fuel element performance computer modelling; Preston, UK (15 Mar 1982).

The analysis of the fuel rod behavior under severe core damage conditions suffers from a very unspecified knowledge of the slumping processes. To investigate the behavior of fuel rods under meltdown conditions a theoretical and experimental program was initiated by the German Government. Both single rod and bundle experiments were performed at the Projekt Nukleare Sicherheit (PNS) in Karlsruhe. In this paper, a description of the calculational model ('EXMEL') developed to support the experiments will be given. Also computations of calculated data and measured values are shown. Finally extrapolations of the experimental insight to whole core conditions will be given. Based on the 'RSYST' data management system, the modular program system 'EXMEL' contains separate modules for the main physical processes. Modules exist for the simulation of heat production, heat transfer within the gap between fuel and clad, clad oxidation, the determination of boundary conditions for the rod and the deformation of the rod by thermal strains. Particular attention was paid to the appropriate modelling of the melting of the rod material, the rupture of the clad and the run-off and refreezing of molten material. The entire program system as well as each module was developed in accordance with the understanding of the experiments. All comparisons of experimental data and the results obtained by applying the 'EXMEL' code indicate a reasonably good agreement. The 'EXMEL' code was applied also to predict the fuel rod behavior of the Three Mile Island-2 reactor core. Results will be given.

25653 (IWGFPT—13, pp 715-721) **Computer modelling of water reactor fuel element performance and life time.** Bibilashvili, Yu.K.; Golovnin, I.S.; Elesin, V.F. (Vsesoyuznyj Nauchno-Issledovatel'skij Inst. Neorganicheskikh Materialov, Moscow, USSR). Mar 1983. NTIS (US Sales Only), PC A99/MF A01. File Number DE84900984. (CONF-820360—).

From IAEA specialists meeting on water reactor fuel element performance computer modelling; Preston, UK (15 Mar 1982).

Well calibrated models and methods of calculation permit the confident prediction of fuel element behaviour under most different operational conditions; based on the prediction of this kind

one can improve designs and fuel element behaviour. Therefore, in the Soviet Union in the development of reactor cores for NPP one of the leading parts is given to design problems associated with computer modelling of fuel element performance and reliability. Special attention is paid to methods of calculation that permit the prediction of fuel element behaviour under conditions which either make experimental studies very complicated (practically impossible) or require laborious and expensive in-pile tests. Primarily it concerns accidents of different types, off-normal conditions, transients, fuel element behaviour at high burn-up, when an accumulation of a great amount of fission fragments is accompanied by changes in physical and mechanical properties as induced by irradiation damage, mechanical fatigue, physical and chemical reactions with a coolant, fission products etc. Some major computer modelling programs for the prediction of water reactor fuel behaviour are briefly described below and tendencies in the further development of work in this area are summarized.

25654 (IWGFPT—13, pp 119-126) **Behaviour of short-lived fission products within operating UO_2 fuel elements.** Hastings, I.J.; Hunt, C.E.L.; Lipsett, J.J. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Mar 1983. NTIS (US Sales Only), PC A99/MF A01. File Number DE84900984. (CONF-820360—).

From IAEA specialists meeting on water reactor fuel element performance computer modelling; Preston, UK (15 Mar 1982).

We have carried out experiments using a "sweep gas" technique to determine the behaviour of short-lived fission products within operating, intact UO_2 fuel elements. The Zircaloy-4-clad elements were 500 mm long and contained fuel of density 10.65-10.71 Mg/m^3. A He-2% H_2 carrier gas swept gaseous or volatile fission products out of the operating fuel element past a gamma spectrometer for measurement. In tests at linear powers of 45 and 60 kW/m to maximum burnups of 70 MW.h/kg U, the species measured directly at the spectrometer were generally the short-lived xenons and kryptons. We did not observe iodine or bromine during normal operation. However, we have deduced the behaviour of I-133 and I-135 from the decay of Xe-133 and Xe-135 during reactor shutdowns. Plots of R/B (released/born) against lambda (decay constant) or effective lambda for all isotopes observed at 45 and 60 kW/m show that a line of slope -0.5, corresponding with diffusion kinetics, is a good fit to the measured xenon and krypton data. Our inferred release of iodine fits the same line. From this we can extrapolate to an R/B for I-131 of about 5×10^{-3}. The ANS 5.4 release correlation gives calculated results in good agreement with our measurements.

25655 (IWGFPT—13, pp 127-146) **URGAP: A gap conductance model for transient conditions.** Lassmann, K.; Pazdera, F. (Kernforschungszentrum Karlsruhe G.m.b.H., Germany, F.R.; Ustav Jaderneho Vyzkumu CSKAE, Rez, Czechoslovakia). Mar 1983. NTIS (US Sales Only), PC A99/MF A01. File Number DE84900984. (CONF-820360—).

From IAEA specialists meeting on water reactor fuel element performance computer modelling; Preston, UK (15 Mar 1982).

A gap conductance model, URGAP, has been developed with contributions from solid, fluid and radiation heat transfer components. Model parameters are easily available, independent of different combinations of material surfaces. The model parameters were fitted to 388 data points under reactor conditions. For model verification, another 274 data points of steel-steel and aluminium-aluminium interfaces, respectively, were used. For minor surface roughnesses normally prevailing in reactor fuel elements the model asymptotically yields Ross' and Stoute's model for the open gap, which is thus confirmed. Materials data were carefully checked over a wide range of temperatures. Special attention was paid to the contact term for high temperatures. Thus, the model can be applied to transients. The URGAP model is being used successfully in several codes.

2204 Control Systems

REFER ALSO TO CITATION(S) 25688

25656 (Juel—2011) **Noise thermometry in nuclear reactors. Contribution on signal transmission of wide-band spectra in noise thermometry.** Hoewener, H. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung; Technische Hochschule Aachen (Germany, F.R.)). Aug 1985. 185p. (In German). NTIS (US Sales Only), PC A09/MF A01. File Number DE86751107.

Since in nuclear reactors the measuring sensor cannot be easily replaced, the value of the sensor resistance, as well as the selection of transmission lines with respect to good transmission characteristics of the whole arrangement and minimizing the correlative error terms, must already be optimized when designing a noise thermometer arrangement. The TRARAU computer program was developed for this purpose enabling the influences of the lines to be computed by taking into consideration all the effects occurring through the lines, such as transmission errors and correlative error terms. In order to check the accuracy of the TRARAU computer program a series of laboratory measurements were implemented enabling both the pure transmission behaviour of the line arrangement with respect to the measuring signal to be detected, as well as the overall line error. In all cases this resulted in a very good agreement of the measured values with the computed values. The transmission behaviour of noise thermometer arrangements occurring in practice were studied with the example of two reactor experiments. In both cases it was possible to demonstrate successfully the potential of the computer program TRARAU. As the parametric studies have shown, optimum matching over unlimited band widths is not feasible in principle. By reducing the upper band limit, however, the line error can practically always be kept sufficiently small. With good matching larger band widths can also be used. (orig./HP).

25657 (RISO-M—2511) **Functional alarming and information retrieval.** Goodstein, L.P. (Risoe National Lab., Roskilde (Denmark)). Aug 1985. 18p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701408.

This paper deals with two facets of the design and efficient utilisation by operating personnel of computer-based interfaces for monitoring and the supervisory control of complex industrial systems - e.g., power stations, chemical plants, etc. These are alarming and information retrieval both of which are extremely sensitive to computerisation. For example, the advent of computers for display requires that some means of assuring easy and rapid access to large amounts of relevant stored information be found. In this paper, alarming and information retrieval are linked together through a multilevel functional description of the target plant. This representation serves as a framework for structuring the access to information as well as defining associated "alarms" at the various descriptive levels. Particular attention is paid to the level where mass and energy flows and balances are relevant. It is shown that the number of alarms here is reduced considerably while information about content and interrelationships is enhanced - which at the same time eases the retrieval problem.

25658 (RISO-M—2519) **Framework for cognitive task analysis in systems design.** Rasmussen, J. (Risoe National Lab., Roskilde (Denmark)). Aug 1985. 27p. (CONF-8509150—5). NTIS (US Sales Only), PC A03/MF A01. File Number DE86701410.

From NATO advanced study institute on laser surface treatment of metals; San Miniato, Italy (2 Sep 1985).

The present rapid development of advanced information technology and its use for support of operators of complex technical systems are changing the content of task analysis towards the analysis of mental activities in decision making. Automation removes the humans from routine tasks, and operators are left with disturbance control and critical diagnostic tasks, for which computers are suitable for support, if it is possible to match the computer strategies and interface formats dynamically to the requirements of the current task by means of an analysis of the cognitive task. Such a cognitive task analysis will not aim at a description of the information processes suited for particular control situations. It will

rather aim at an analysis in order to identify the requirements to be considered along various dimensions of the decision tasks, in order to give the user - i.e. a decision maker - the freedom to adapt his performance to system requirements in a way which matches his process resources and subjective preferences. To serve this purpose, a number of analyses at various levels are needed to relate the control requirements of the system to the information processes and to the processing resources offered by computers and humans. The paper discusses the cognitive task analysis in terms of the following domains: The problem domain, which is a representation of the functional properties of the system giving a consistent framework for identification of the control requirements of the system; the decision sequences required for typical situations; the mental strategies and heuristics which are effective and acceptable for the different decision functions; and the cognitive control mechanisms used, depending upon the level of skill which can/will be applied.

25659 **(RISO-M—2520) Conceptual models in man-machine design verification.** Rasmussen, J. (Risoe National Lab., Roskilde (Denmark)). Aug 1985. 16p. (CONF-8506100—8). NTIS (US Sales Only), PC A02/MF A01. File Number DE86701411.

From 3. IEEE conference on human factors and power plants; Monterey, CA, USA (23 Jun 1985).

The need for systematic methods for evaluation of design concepts for new man-machine systems has been rapidly increasing in consequence of the introduction of modern information technology. Direct empirical methods are difficult to apply when functions during rare conditions and support of operator decisions during emergencies are to be evaluated. In this paper, the problems of analytical evaluations based on conceptual models of the man-machine interaction are discussed, and the relations to system design and analytical risk assessment are considered. Finally, a conceptual framework for analytical evaluation is proposed, including several domains of description: 1. The problem space, in the form of a means-end hierarchy; 2. The structure of the decision process; 3. The mental strategies and heuristics used by operators; 3. The levels of cognitive control and the mechanisms related to human errors. Finally, the need for models representing operators' subjective criteria for choosing among available mental strategies and for accepting advice from intelligent interfaces is discussed.

25660 **(RISO-M—2522) Studies of operator-computer cooperation on a small-scale nuclear power plant simulator.** Goodstein, L.P. (Risoe National Lab., Roskilde (Denmark)). Aug 1985. 24p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701412.

A modest-sized testbed, based on a PWR-like process model, and called GNP (for Generic Nuclear Plant) is being used at Risoe for studies of human-computer cooperation in various decision-making situations. The experimental program is based on various conceptual ideas which are aimed at supporting the development of a robust and well-founded framework for the design of appropriate information displays for these kinds of tasks. The paper describes GNP as well as the types of presentation which are being studied with the testbed. Preliminary results are presented.

25661 **(RISO-M—2525) Decision support in supervisory control.** Rasmussen, J.; Goodstein, L.P. (Risoe National Lab., Roskilde (Denmark)). Aug 1985. 23p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701413.

It is argued that the supervisory control of complex industrial processes having a potential for serious consequences in case of accidents requires careful consideration of the allocation of decision making between the three main agents of control; namely the designer, the operator and the automatic control system. In particular, it is advocated that instead of continuing their efforts to make their preplanning of responses and countermeasures more and more complete and restricting the operator's initiative, designers should take advantage of modern information technology to make available to the operators their conceptual models and their processing resources so as to allow the operators to function as their extended arm in coping with the plant. Such an interactive decision making activity would thus benefit from this simultaneous availability of the design basis, up-to-date knowledge of plant status and accumulated operational experience.

2205 Environmental Aspects

REFER ALSO TO CITATION(S) 25672

2206 Research, Test, And Experimental Reactors

REFER ALSO TO CITATION(S) 25669, 25678, 25679, 25680

25662 **(JAERI-M—84-168) Annual progress report on the NSRR experiments, (15). January 1983 through December 1983.** Saito, Shinzo; Horiki, Oichiro; Fujishiro, Toshio. (Japan Atomic Energy Research Inst., Tokyo). Oct 1984. 255p. (In Japanese). NTIS (US Sales Only), PC A12/MF A01. File Number DE86701425.

Fuel behavior studies in simulated reactivity initiated accident (RIA) conditions have been performed by utilizing Nuclear Safety Research Reactor (NSRR) since October, 1975. This report describes the results obtained from January through December, 1983. A total of 51 tests were carried out during this period; those are 4 standard fuel rod tests (4 high energy deposition tests), 5 fuel design parameter tests (1 pre-pressurized fuel rod test, 3 stainless steel cladding fuel rod tests and 1 pre-irradiated clad fuel rod test), 6 cooling condition parameter tests (2 coolant temperature parameter tests, 1 forced convection test and 3 bundle rod tests), 3 defected fuel rod tests (3 fretting corroded clad fuel rod tests), 8 severe fuel damage tests, 2 special fuel rod tests (2 HTGR fuel tests), 3 high temperature high pressure capsule tests, 2 high temperature high pressure loop tests, 6 fuel behavior observation tests, and 12 miscellaneous tests (acoustic measurement tests, pellet acceleration measurement tests, fuel rod deformation measurement tests, etc).

25663 **(NUCLEBRAS-CDTN—496) Role of a research nuclear reactor within the framework of mineral prospection and processing programs.** Carvalho Tofani, P. de; Stasiulevicius, R.; Sabino, C.V.S.; Maretti Junior, F. (NUCLEBRAS, Belo Horizonte (Brazil)). 1982. 11p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701632.

The Empresas Nucleares Brasileiras S.A. - NUCLEBRAS own the only TRIGA MARK I nuclear reactor in Brazil, which is in operation at the Centro de Desenvolvimento da Tecnologia Nuclear - CDTN, in Belo Horizonte. This reactor has been in operation since 1960 and was formerly intended for training, research and isotope production. Nowadays, it is worthwhile to emphasize its further application, as an important tool devoted to the chemical analyses, based on neutron-gamma and neutron-fission nuclear reactions. An amount of about 240,000 mineral samples have been irradiated in the reactor, since the foundation of the NUCLEBRAS, in 1974. The analytical determinations according to activation methods allowed for a better evaluation of the uranium ore resources and, consequently, contributed to the achievement of present Brazilian position in the world market.

25664 **(PB—86-167863/XAB) NBS (National Bureau of Standards) Reactor: summary of activities July 1984 through June 1985.** Shorten, F.J. (National Bureau of Standards, Washington, DC (USA). Reactor Radiation Div.). Dec 1985. 178p. (NBS/TN—1217). NTIS, PC A09/MF A01.

The report summarizes all those programs which depend on the NBS reactor. It covers the period from July 1984 through June 1985. The programs range from the use of neutron beams to study the structure and dynamics of materials through nuclear physics and neutron standards to sample irradiations for activation analysis, isotope production, radiation effects studies, neutron radiography, and nondestructive evaluation.

25665 **Microscopic investigation into the irradiation behavior of U_3O_8-Al dispersion fuel.** Hofman, G.L.; Copeland, G.L.; Sanecki, J.E. (Argonne National Lab., 9700 S. Cass Ave., Argonne, IL 60439). *Nuclear Technology;* 72: No. 3, vp(Mar 1986).

The recent emphasis on profileration-resistant fuels for research and test reactors has resulted in additional investigations of well-established fuels, such as U_3O_8-Al dispersions, to determine their behavior at the higher fuel densities required for the lower

uranium enrichment. Microstructural investigation of these irradiated fuels with modern techniques has provided insight into the fission gas behavior and its relationship to the U_3O_8-Al interaction during irradiation. These observations explain the observed limitations on fuel loading and safe levels of fission density achievable with these fuels.

2207 Plutonium And Isotope Production Reactors

REFER ALSO TO CITATION(S) 25962

2209 Reactor Safety

25666 **(BMI—1985-086) Possibilities for hydrogen removal. Phase III/2: Deliberate ignition as countermeasure for hydrogen control in case of hypothetical severe accidents in pressurized water reactors.** Langer, G.; Scheibel, H.G. (Bundesministerium des Innern, Bonn (Germany, F.R.)). Oct 1985. 98p. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE86751113.

Schriftenreihe Reaktorsicherheit und Strahlenschutz.

The safety-related problems were investigated in detail during the period reported here (1st January, 1984 to 31st March, 1985). For this purpose the most recent research efforts, which are under way especially in the USA, have been evaluated. The major results of this evaluation may be summarized as follows: So far, the question of reliable function especially under extreme conditions (e.g. high steam concentration while fog is present at the same time) has not been fully clarified. The question concerning the behaviour of safety-related components during hydrogen combustion (survivability) has not been fully clarified either. Additional investigations are necessary to be able to determine how these problems can be solved, if at all. In the light of current knowledge it appears that the latter of the two questions can be answered more readily than the first. (orig./HP).

25667 **(CEGB-TPRD/B—0508/N84) Reactor fault simulation at the closure of the Windscale advanced gas-cooled reactor: analysis of reactor transient tests.** Desoisa, J.A.; Greef, C.P. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Aug 1984. 25p. (CONF-840914—36; AFS-P—84-20; AMPNK-P—84-30; PKT-P—84-29). NTIS (US Sales Only), PC A02/MF A01. File Number DE86701419.

From International meeting on thermal nuclear reactor safety; Karlsruhe, F.R. Germany (10 Sep 1984).

The testing of fault transient analysis methods by direct simulation of fault sequences on a commercial reactor is clearly excluded on safety and economic grounds. The closure of the Windscale prototype advanced gas-cooled reactor (WAGR) therefore offered a unique opportunity to test fault study methods under extreme conditions relatively unfettered by economic constraints, although subject to appropriate safety regulations. One aspect of these important experiments was a series of reactor transient tests. The objective of these reactor transients was to increase confidence in the fault study computer models used for commercial AGR safety assessment by extending their range of validation to cover large amplitude and fast transients in temperature, power and flow, relevant to CAGR faults, and well beyond the conditions achievable experimentally on commercial reactors. A large number of tests have now been simulated with the fault study code KINAGRAX. Agreement with measurement is very good and sensitivity studies show that such discrepancies as exist may be due largely to input data errors. It is concluded that KINAGRAX is able to predict steady state conditions and transient amplitudes in both power and temperature to within a few percent.

25668 **(CONF-850917—7) Criticality analyses for TMI-2 defueling.** Westfall, R.M. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 24p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86008974.

From Topical meeting on criticality safety and the storage of fissile material; Jackson, WY, USA (9 Sep 1985).

A bounding strategy has been adopted for assuring subcriticality during all TMI-2 defueling operations. The strategy is based upon establishing a safe soluble boron level for the entire reactor core in an optimum reactivity configuration. This paper presents the determination of a fuel rubble model which yields a maximum infinite lattice multiplication factor and the subsequent application of cell-averaged constants in finite system analyses. Included in the analyses are the effects of fuel burnup determined from a simplified power history of the reactor. A discussion of the analytical methods employed and the determination of an analytical bias with benchmark critical experiments completes the presentation. 14 refs.

25669 **(CONF-860501—1) Retrospective view of fast reactor safety: EBR-I to the present.** Hummel, H.H. (Argonne National Lab., IL (USA)). 1986. Contract W-31-109-ENG-38. 4p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85014990.

From Conference on the science and technology of fast reactor safety; Channel Islands, UK (12 May 1986).

An early concern in fast reactor safety was that the positive Doppler coefficient of fissile material was a significant effect and was responsible for the positive temperature coefficient of EBR-I, which led to meltdown of the core. Another primary concern for early, metal-fueled fast reactors was the possibility of gravity collapse of the molten core. As reactors became larger, it became apparent that this process would lead to unacceptably large energy releases, providing an incentive for more detailed modeling. As fast reactor safety developed, the importance of reactivity effects other than gravity fuel slumping became evident. For the TOP accident, fuel motion modeling as embodied in such codes as EPIC and PLUTO2 showed that if pin failure occurred at or near the top of the core, consistent with higher clad temperatures, a benign outcome was assured. As the newer codes tended to given more benign results for the initiation phase of CDA's, more attention has been focused on the transition to extensive gradual core melting. 12 refs. (JDB)

25670 **(CONF-860501—2) Review of US models and codes for analysis of whole-core transients and accidents in fast reactors.** Deitrich, L.W. (Argonne National Lab., IL (USA)). 1986. Contract W-31-109-ENG-38. 3p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86005474.

From Conference on the science and technology of fast reactor safety; Channel Islands, UK (12 May 1986).

For many years, study of whole-core transients and accidents in fast reactors has been a major element of safety research and development programs in the US. Numerous models and computer codes have been developed and validated for use in these studies. Historically, emphasis has been placed on describing the core disruptive accident, but more recently emphasis has shifted to describing accident sequences prior to core disruption, with a focus on modeling the mechanisms which could terminate a sequence prior to core disruption. The major models and codes related to transient and accident analysis are reviewed with discussion of the state of development and validation. 9 refs.

25671 **(EGG-TMI—7150) TMI-2 core debris bed coolability.** Kuan, P. (EG and G Idaho, Inc., Idaho Falls (USA)). Mar 1986. Contract AC07-76ID01570. 41p. NTIS, PC A03/MF A01; GPO Dep. File Number DE86009091.

This report studies the thermal behavior of debris beds impermeable to cooling water. It considers these debris beds as idealizations of the slumped TMI-2 core as conjectured between 2 h, 54 min and 3 h, 46 min into the accident. Section 2 calculates the decay heat levels as functions of time after shutdown, assuming various fractions of the more volatile fission products were released during the earlier high temperature transient up to 2 h, 54 min. Section 3 determines the thermal properties of the debris-bed material as function of fuel content in a mixture of uranium dioxide and zircaloy. With these parameters, Section 4 calculates the equilibrium temperature profiles in slab geometry for various sizes and compositions of the debris bed. Calculations were carried out to determine the minimum thickness of debris beds that have a molten interior under equilibrium conditions and the equilibrium thicknesses of the solid crusts of debris beds having molten interiors as functions of their overall dimension. Hopefully, these calculated parameters will help determine a lower size limit of the TMI-2 debris bed below which molten core material could not have flowed down to the

lower plenum. In Section 5, a one-dimensional, slab geometry, transient heatup calculation was performed for a best-estimate configuration of the TMI-2 debris bed after its formation (about 2 h, 54 min into the accident).

25672 **(EIR—553) DEMONA Annual report 1984.** Schoeck, W. (Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen (Switzerland)). Jun 1985. 78p. (In German). (BF-R—65.523-30-3; GRS-A—1078; KWU-R—917/85/103). NTIS (US Sales Only), PC A05/MF A01. File Number DE86701418.

The DEMONA program is conducted to demonstrate nuclear aerosol behaviour in large scale experiments. It is to be shown that the NAUA aerosol code is capable of describing sufficiently well the typical aerosol behaviour during accidents in PWRs. DEMONA also will improve the coupling of aerosol (NAUA) and thermodynamic (COCMEL) codes. The experiments are carried out in the model containment facility at Battelle Frankfurt which is a quarter scale model of the Biblis A containment. The geometric and thermodynamic properties of the model containment allow a realistic simulation of the conditions during core melt accidents. In 1984 21 tests were done to improve and optimize the aerosol generation techniques. Four long term aerosol removal experiments were carried out, two of which satisfy the aims of the DEMONA test matrix as dry test and base experiment. The measured aerosol behaviour was in very good agreement with pre-test predictions and post-test calculations with NAUA. This report describes the experiments and gives the essential results.

25673 **(ENEA-RT-DISP—83-2) Transient one-volume calculations for a PWR equipped with a core rescue system (SSN).** Petrangeli, G. . (ENEA, Rome (Italy)). 1983. 115p. NTIS (US Sales Only), PC A06/MF A01. File Number DE86701406.

The simplified thermal-hydraulic calculations used in order to assess the feasibility and effectiveness of a Core Rescue System (SSN) for PWRs have been collected here. SSN systems essentially consist of an augmentated (with reference to relief lines) primary system automatic depressurization line, of low pressure borated water accumulator lasting for many hours and of a direct contact condenser for the dissipation of heat to the environment. Although some final verifications have to be completed, it can now be considered well proven that these systems are capable of making a PWR at least ten times safer than most designs. This is due to their characteristics of simplicity, direct detection and action, passive operation. This conclusion relies on analysis and calculations performed at DISP, at ENEA/TERM/MEP and elsewhere. Simple engineering methods such as those shown in this report have been and may be a useful guide in the use of more accurate, and therefore less flexible, calculations.

25674 **(ENEA-RT-DISP—83-5) Thermomechanical effects of a postulated spurious actuation of a core rescue system (SSN).** Milella, P.; Petrangeli, G. (ENEA, Rome (Italy)). 1983. 80p. NTIS (US Sales Only), PC A05/MF A01. File Number DE86701407.

Safety system for the prevention of LWR core severe damage have recently been studied which are based on automatic primary system depressurization and on borated water injection by low pressure accumulators. These systems have been named Core Rescue Systems (SSN). Some concern might arise regarding the effects of a thermal shock on the pressure boundary, following a postulated spurious SSN actuation. Although this event is already included, as intermediate LOCA, in the plant design basis, a closer look to the pertinent phenomena is here given in order to more precisely access available safety margins. The conclusion of this study is that the spurious activation of SSN system, although entailing a significant (non pressurized) thermal shock, does not pose any threat to pressure boundary integrity provided pressure vessel mechanical properties are acceptably good. On the contrary, the availability of such a system at a plant may offer additional means to avoid pressurized overcooling transients of different origin.

25675 **(EPRI-NP—4306-SR) Safety and relief valves in light water reactors.** Singh, A. (ed.). (Electric Power Research Inst., Palo Alto, CA (USA)). Dec 1985. 188p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI86920221.

Information is presented to: provide an introduction to and descriptions of various types of safety and relief valves in both PWR and BWR plants; describe anticipated operating conditions for these valves; describe the test facilities, procedures, and major results for both types of valves; present an extensive discussion of modeling and analysis of safety and relief valve performance, including the prediction of flow capacity and stability during operation; deal with the analyses related to the prediction of thermal-hydraulic loads on discharge piping and comparison against test data; discuss results of small-scale valve tests and flow visualization studies through transparent valve models; and describe an EPRI study for optimizing a typical PWR over-pressure protection system to enhance the availability and reliability of plant operation and thus reduce operation costs. (JDB)

25676 (IAEA-TECDOC—344, pp 112-117) **Emergency core cooling examinations for the light water high conversion reactor (LWHCR).** Schumann, S. (Kraftwerk Union A.G., Erlangen, Germany, F.R.). Sep 1985. NTIS (US Sales Only), PC A10/MF A01. File Number DE86701630. (CONF-8411237—).

From Technical committee and workshop on advanced light and heavy water reactor technology; Vienna, Austria (26 Nov 1984).

The KWU-concept of the LWHCR is scheduled to use as many components of a conventional PWR as possible. For the realization it must be demonstrated that an unchanged ECC-system can control all accidents which are required in normal PWR-licensing. The purpose of this contribution is to examine the efficiency of ECC in comparison to the PWR. A double ended rupture of the main coolant line between the reactor pressure vessel and main coolant pump normally results in the highest canning temperatures. Therefore, this accident is the basis used for the present analysis. The 1300 MWsub(e)-Philippsburg-2 plant serves as the PWR-reference. Calculations for the blowdown, the refill and the reflooding phase with combined coolant injection were performed with the KWU-codes used for licensing analyses. The essential differences between a PWR and a LWHCR that are relevant for the ECC are the lower linear rating, the reduced core-flow area as well as the short core height. Their influence on emergency core cooling behavior is discussed. In general, very encouraging results were obtained. Decisive for the favourable temperature course during blowdown are the lower stored heat and the better heat transfer. While the core upstream line contains some more resistances beside the core, the higher LWHCR-core resistance reduces the massflow only about 25%. Therefore the flow velocity remains still higher in the LWHCR and with that the heat transfer. After blowdown more stored heat is removed and the core has lower temperatures than the PWR. That defuses the refill- and reflood phase of the LOCA. Although the flow rate from the upper plenum to the core is reduced compared to the PWR, because of the smaller hydraulic diameter, the short core ensures an overall earlier quenching. A likewise favourable result was obtained with regard to the hot spot cladding temperatures. They are considerably below the values for PWR with 16x16 type fuel elements.

25677 (IWGFPT—13, pp 373-386) **Modelling the mechanical restraint of the deformation of Zircaloy cladding in a non-uniform environment, using the CANSWEL-2 code.** Haste, T.J. (UKAEA Springfields Nuclear Power Development Labs.). Mar 1983. NTIS (US Sales Only), PC A99/MF A01. File Number DE84900984. (CONF-820360—).

From IAEA specialists meeting on water reactor fuel element performance computer modelling; Preston, UK (15 Mar 1982).

The CANSWEL-2 code, which models the creep deformation of Zircaloy cladding under loss-of-coolant accident conditions in the presence of azimuthal variations in wall thickness and temperature, has been modified to allow improved calculation of subchannel shapes at high blockages (>60%). The mechanical restraint model, which previously treated interaction only between the

centre and outer rods of a 3 x 3 square array, has been extended to include flattening between the outer rods as well. Comparisons are made between predicted and observed rod cross-sections for cases in which both deforming and rigid rods are present. The operation of the model is illustrated by application to arrays of deforming cladding in which alternate rods have high and low strains, and also to cases including the presence of a non-straining rod. The use of the model in the accident analysis code MABEL-2C is discussed.

25678 (JAERI-M—84-073, pp 289-298) **Comparison of the Aerospace Systems Test Reactor loss-of-coolant test data with predictions of the 3D-AIRLOCA code.** Warinner, D.K. (Argonne National Lab., IL, USA). May 1984. NTIS (US Sales Only), PC A24/MF A01. File Number DE86780116. (CONF-8310173—).

From Nuclear explosives design conference; Los Alamos, NM, USA (15 Oct 1983).

This paper compares the predictions of the revised 3D-AIRLOCA computer code to those data available from the Aerospace Systems Test Reactor's (ASTR's) loss-of-coolant-accident (LOCA) tests run in 1964. The theoretical and experimental hot-spot temperature responses compare remarkably well. In the thirteen cases studied, the irradiation powers varied from 0.4 to 8.87 MW; the irradiation times were 300, 1540, 1800, and 10^4 s. The degrees of agreement between the data and predictions provide an experimental validation of the 3D-AIRLOCA code.

25679 (JAERI-M—84-073, pp 299-310) **Calculations of partial LOCA in a swimming-pool-reactor with MTR-elements and planned mock-up experiment.** Dreier, J.; Winkler, H. (Swiss Federal Inst. for Reactor Research, Wuerenlingen, Switzerland). May 1984. NTIS (US Sales Only), PC A24/MF A01. File Number DE86780116. (CONF-8310173—).

From Nuclear explosives design conference; Los Alamos, NM, USA (15 Oct 1983).

A partial uncovering of the MTR fuel plates of the swimming pool reactor SAPHIR located at the Swiss Federal Reactor Research Institute (E.I.R.) could be caused by a loss of coolant accident due to a beam tube break. The transient temperature excursions of the fuel plates during the LOCA have been predicted with computer simulations. Because a reliable prediction of the flow regime and hence the heat transfer in the uncovered part of the plate is not possible with current knowledge, a parametric study employing different heat transfer models is presented in this paper. The results show that the heat transfer model in the uncovered part of the fuel plate has an important influence on the predicted temperatures. A mock-up experimental facility, which will supply data for the heat transfer occuring in the uncovered part, will also be described at the end of the paper.

25680 (JAERI-M—84-073, pp 311-320) **CHF correlations related to the core cooling of a research reactor.** Mishima, K.; Nishihara, H.; Shibata, T. (Kyoto Univ., Kumatori, Osaka, Japan. Research Reactor Inst.). May 1984. NTIS (US Sales Only), PC A24/MF A01. File Number DE86780116. (CONF-8310173—).

From Nuclear explosives design conference; Los Alamos, NM, USA (15 Oct 1983).

Critical heat flux (CHF) at low flow condition can become important in a research reactor under a number of accident conditions. Regardless of the initial stages of these accidents, a similar condition, which is basically the decay heat removal by natural convection boiling, can develop. Under such conditions, burnout may occur even at a very low heat flux. In view of this, the low-flow CHF has been studied to provide a better understanding of the dryout behavior. The experimental results under atmospheric pressure indicate that a CHF can occur at much lower heat flux than pool-boiling CHF or than predicted by the conventional correlations. This fact indicates that a special care should be taken in analyzing the boiling phenomenon which occurs when the coolant flow is very low in a low pressure system.

25681 (NUREG/CR—4374-Vol.1) **Review of the Oconee-3 probabilistic risk assessment: internal events, core damage frequency. Volume 1.** Hanan, N.A.; Ilberg, D.; Xue, D.; Fitzpatrick, R.G.; Chu, T.L. (Brookhaven National Lab., Upton, NY (USA)). Mar 1986. Contract AC02-76CH00016. 173p. (BNL-NUREG—51917-Vol.1). NTIS, PC A08/MF A01 - GPO. File Number TI86009020.

A review of the Oconee-3 Probabilistic Risk Assessment (OPRA) was conducted with the broad objective of evaluating the contribution of the internally-generated accidents to the frequency of core damage. The review included a technical assessment of the assumptions and methods usd in the OPRA study. The BNL staff reevaluated the main results of the study within the scope and general methodological framework, including both qualitative and quantitative analyses of accident initiators, and accident sequences which result in core damage. The effect of uncertainties was considered throughout the review process, and the uncertainty bands for the core damage frequency were quantified. 30 figs., 36 tabs.

25682 (NUREG/CR—4374-Vol.2) **Review of the Oconee-3 probabilistic risk assessment: external events, core damage frequency. Volume 2.** Hanan, N.A.; Ilberg, D.; Xue, D.; Youngblood, R.; Reed, J.W.; McCann, M.; Talwani, T.; Wreathall, J.; Kurth, P.D.; Bandyopadhyay, K. (Brookhaven National Lab., Upton, NY (USA)). Mar 1986. Contract AC02-76CH00016. 270p. (BNL-NUREG—51917-Vol.2). NTIS, PC A12/MF A01 - GPO. File Number TI86009021.

A review of the Oconee-3 Probabilistic Risk Assessment (OPRA) was conducted with the broad objective of evaluating qualitatively and quantitatively (as much as possible) the OPRA assessment of the important sequences that are "externally" generated and lead to core damage. The review included a technical assessment of the assumptions and methods used in the OPRA within its stated objective and with the limited information available. Within this scope, BNL performed a detailed reevaluation of the accident sequences generated by internal floods and earthquakes and a less detailed review (in some cases a scoping review) for the accident sequences generated by fires, tornadoes, external floods, and aircraft impact. 12 refs., 24 figs., 31 tabs.

25683 (NUREG/CR—4452) **Review of RELAP5 calculations for H.B. Robinson Unit 2 pressurized thermal shock study.** Yuelys-Miksis, C.; Rohatgi, U.S.; Jo, J.J. (Brookhaven National Lab., Upton, NY (USA)). Dec 1985. Contract AC02-76CH00016. 61p. (BNL-NUREG—51946). NTIS, PC A04/MF A01 - GPO. File Number TI86007025.

Idaho National Engineering Laboratory (INEL) used the RELAP5/MOD1.6 code to simulate a number of transient scenarios for the USNRC PTS study of the H.B. Robinson Unit-2 PWR plant. Eleven of these scenarios were reviewed at BNL on the basis of information received before September 30, 1984. Six of these eleven scenarios were selected for an in-depth quantitative analysis performed on the basis of a simple method developed at BNL. However, the detailed analysis of two of these transients, namely transients 1 and 4 are not presented here as they have since been recalculated by INEL and the new calculations could not be reviewed at BNL due to budgetary constraints. The simple method uses the mass and energy balance equations to predict the temperature and pressure of the reactor system. The results of these calculations were compared to the RELAP5 results and the INEL extrapolations. In general, the RELAP5 and INEL results appear to be reasonable.

25684 (NUREG/CR—4459) **Light Water Reactor Safety Research Program. Semiannual report, October 1983-March 1984.** Berman, M. (Sandia National Labs., Albuquerque, NM (USA)). Feb 1986. Contract AC04-76DP00789. 131p. (SAND—85-2500). NTIS, PC A07/MF A01 - GPO. File Number TI86009035.

This report describes the investigations and analyses conducted at Sandia National Laboratories, Albuquerque, in support of the Light Water Reactor Safety Research Program from October 1983 through March 1984. The Fuel-Coolant Interactions Study investigates the mechanism of concrete erosion by molten core materials, the nature and rate of generation of evolved gases, and the

effects of fission-product release. The Hydrogen Behavior and Mitigative and Preventive Schemes Programs investigate the HECTR code for modeling hydrogen deflagration, and the Grand Gulf Igniter System II is being reviewed. All activities are continuing. 53 figs., 11 tabs.

25685 **(NUREG/CR—4486) VISA-II: a computer code for predicting the probability of reactor pressure vessel failure.** Simonen, F.A.; Johnson, K.I.; Liebetrau, A.M.; Engel, D.W.; Simonen, E.P. (Pacific Northwest Labs., Richland, WA (USA)). Mar 1986. Contract AC06-76RL01830. 127p. (PNL—5775). NTIS, PC A07/MF A01 - GPO. File Number TI86009173.

The VISA-II (Vessel Integrity Simulation Analysis code was originally developed as part of the NRC staff evaluation of pressurized thermal shock. VISA-II uses Monte Carlo simulation to evaluate the failure probability of a pressurized water reactor (PWR) pressure vessel subjected to a pressure and thermal transient specified by the user. Linear elastic fracture mechanics methods are used to model crack initiation and propagation. Parameters for initial crack size and location, copper content, initial reference temperature of the nil-ductility transition, fluence, crack-initiation fracture toughness, and arrest fracture toughness are treated as random variables. This report documents an upgraded version of the original VISA code as described in NUREG/CR-3384. Improvements include a treatment of cladding effects, a more general simulation of flaw size, shape and location, a simulation of inservice inspection, an updated simulation of the reference temperature of the nil-ductility transition, and treatment of vessels with multiple welds and initial flaws. The code has been extensively tested and verified and is written in FORTRAN for ease of installation on different computers. 38 refs., 25 figs.

25688 **(NUREG/CR—4545) Pipe crack evaluation in operating boiling water reactors.** Auerbach, C.; Czajkowski, C.J.; Sanborn, Y.; Teutonico, L.J.; van Rooyen, D.; Weeks, J.R. (Brookhaven National Lab., Upton, NY (USA)). Mar 1986. Contract AC02-76CH00016. 59p. (BNL-NUREG—51965). NTIS, PC A04/MF A01 - GPO. File Number TI86009022.

The reliability of NDE techniques is reviewed based on experience through the end of 1983. Acceptability of proposed repair techniques for cracked BWR piping and of mitigating measures is discussed, including the proposed weld overlay technique, environmental mitigating measures, and other stress related remedial measures. 36 refs.

25687 **(NUREG/CR—4565) Probabilistic Safety Study Applications Program for inspection of the Indian Point Unit 3 Nuclear Power Plant.** Taylor, J.H.; Fullwood, R.; Fresco, A. (Brookhaven National Lab., Upton, NY (USA)). Mar 1986. Contract AC02-76CH00016. 72p. (BNL-NUREG—51973). NTIS, PC A04/MF A01 - GPO. File Number TI86009124.

By prioritizing the various areas of interest for inspection and by better defining inspection needs, the NRC expects to make more effective use of finite inspection resources by concentrating on those potential areas most significant to safety. Through review and application of the Indian Point Unit 3 Probabilistic Safety Study's numerical data and event tree modeling, and by utilizing related documents, a technical basis for prioritizing areas for NRC inspection has been developed. This was then tested at the plant site for the NRC Operating Reactor Inspection Program, I and E Manual Chapter 2515. Inspection activities addressed include normal operations, system and component testing, maintenance and surveillance. A computer program entitled NSPKTR, which was developed specifically for this program, modeled the internal plant states to the system level and performed the risk and importance calculations. 17 refs., 21 tabs.

25686 **(RISO-M—2518) Risk and information processing.** Rasmussen, J. (Risoe National Lab., Roskilde (Denmark)). Aug 1985. 20p. (CONF-8506238—1). NTIS (US Sales Only), PC A02/MF A01. File Number DE86701409.

From Seminar on risk: decisions, concepts, and measures; Oslo, Norway (17 Jun 1985).

The reasons for the current widespread arguments between designers of advanced technological systems like, for instance, nuclear power plants and opponents from the general public concerning levels of acceptable risk may be found in incompatible definitions of risk, in differences in risk perception and criteria for acceptance, etc. Of importance may, however, also be the difficulties met in presenting the basis for risk analysis, such as the conceptual system models applied, in an explicit and credible form. Application of modern information technology for the design of control systems and human-machine interfaces together with the trends towards large centralised industrial installations have made it increasingly difficult to establish an acceptable model framework, in particular considering the role of human errors in major system failures and accidents. Different aspects of this problem are discussed in the paper, and areas are identified where research is needed in order to improve not only the safety of advanced systems, but also the basis for their acceptance by the general public.

25689 **A process inherent ultimate safety boiling water reactor.** Forsberg, C.W. (Oak Ridge National Lab., P.O. Box X, Oak Ridge, TN 37831). *Nuclear Technology;* **72**: No. 2, vp(Feb 1986). Contract AC05-84OR21400.

A new type of boiling water reactor (BWR) - the process inherent ultimate safety (PIUS) BWR - has been conceived. A PIUS BWR is an advanced BWR that differs from the typical BWR in that a prestressed concrete reactor vessel (PCRV) with special internals replaces the conventional pressure vessel, emergency core cooling system, containment shell, spent fuel storage ponds, and most other components on the nuclear island. The reactor core and balance of plant are similar to current BWR designs. This approach effectively eliminates the possibility of reactor core meltdown and simplifies plant design. The PIUS BWR does not require operation of any mechanical or electrical components in any emergency for reactor shutdown or afterheat cooling, nor does it depend on any equipment outside the PCRV. The PCRV contains a natural circulation BWR; cool, borated water for emergency core cooling; a mechanism "X" that allows the cool, borated water to enter the reactor core if there is insufficient water in the core; and a mechanism "Y" that limits core power levels to available cooling capabilities.

25690 **Thermal-hydraulic methods in fast reactor safety.** Weber, D.P.; Briggs, L.L. (Argonne National Laboratory, Reactor Analysis and Safety Division, 9700 S. Cass Avenue, Argonne, IL 60439). *Nuclear Science and Engineering;* **92**: No. 2, vp(Feb 1986).

Methods for the solution of thermal-hydraulic problems in liquid-metal fast breeder reactors arising primarily from transient accident analysis are reviewed. Principal emphasis is given to the important phenomenological issues of sodium boiling and fuel motion. Descriptions of representative phenomenological and mathematical models, computational algorithms, advantages and limitations of the approaches, and current research needs and directions are provided.

25691 **Boiling water reactor plant analyzer development at Brookhaven National Laboratory.** Cheng, H.S.; Wulff, W.; Mallen, A.N.; LeKach, S.V.; Stritar, A.; Cerbone, R.J. (Brookhaven National Laboratory, Upton, NY 11973). *Nuclear Science and Engineering;* **92**: No. 1, vp(Jan 1986).

Advanced technology for high-speed interactive nuclear power plant simulations is of great value for timely resolution of safety issues, for plant monitoring, and for computer-aided emergency responses to an accident. Presented is the methodology employed at Brookhaven National Laboratory to develop a boiling water reactor (BWR) plant analyzer capable of simulating severe plant transients at much faster than real-time process speeds. Five modeling principles are established and a criterion is given for selecting numerical procedures and efficient computers to achieve the very high simulation speeds. Typical results are shown to demonstrate the modeling fidelity of the BWR plant analyzer.

25692 **An advanced multidimensional method for structural and hydrodynamic analysis of liquid-metal fast breeder reactor piping systems.** Wang, C.Y.; Zeuch, W.R. (Argonne National Laboratory, Reactor Analysis and Safety Division, Argonne, IL 60439). *Nuclear Science and Engineering;* 92: No. 1, vp(Jan 1986).

An advanced multidimensional method for structural and hydrodynamic analysis of piping systems of liquid-metal fast breeder reactors under various accident loads is described. The method couples a two-dimensional finite difference hydrodynamic technique with a three-dimensional finite element structural dynamics program. In the analysis, an elbow hydrodynamic model has been developed to account for the effect of global elbow motion. Treatment is provided for calculating fluid motion in the vicinity of the isolated flow region, rigid obstacle, and baffle plates, which commonly occurs in the in-line components. Also, an implicit time-integration scheme has been developed for structural analysis under long-duration accident loads. Three sample problems are given, dealing with analyses of (a) multidimensional fluid-structure interaction, (b) hydrodynamics in the in-line components, and (c) seismic response of a pipe-elbow loop.

25 ENERGY STORAGE

2502 Compressed Gas

25693 **(PNL—5519) Tests of US rock salt for long-term stability of CAES reservoirs.** Gehle, R.M.; Thoms, R.L. (Applied Geomechanics, Inc., Baton Rouge, LA (USA)). Jan 1986. Contract AC06-76RL01830. 103p. NTIS, PC A06/MF A01; GPO Dep. File Number DE86009041.

This is a report on laboratory tests to assess the effects of compressed air energy storage (CAES) on rock salt within the US. The project included a conventional laboratory test phase, with triaxial test machines, and a bench-scale test phase performed in salt mines in southern Louisiana. Limited numerical modeling also was performed to serve as a guide in selecting test layouts and for interpreting test data.

2506 Thermal

REFER ALSO TO CITATION(S) 25486, 25778

25694 **(CONF-850301—12) High-temperature composite thermal energy storage for industrial applications.** Petri, R.J.; Ong, E.T.; Marianowski, L.G. (Institute of Gas Technology, Chicago, IL (USA)). 1985. Contract AC05-84OR21400. 15p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86007267.

From 12. annual energy technology conference and exposition; Washington, DC, USA (25 Mar 1985).

An advanced, thermal energy storage (TES) subsystem is being developed by the Institute of Gas Technology (IGT) which employs composite phase change material (PCM)/sensible heat media (CompPhase). This medium/subsystem is amenable to high temperature thermal storage applications such as industrial reject/process heat recovery and utilization, off-peak utility, and solar thermal and solar dynamic space power systems. The CompPhase concept allows for direct contact heat exchange between the latent/sensible storage media and compatible working fluids. A number of potentially significant TES system performance and cost advantages are thereby offered over conventional tube intensive indirect contact molten-salt latent-heat-based storage subsystems.

25695 **(CTH-JVG—17) Heat storage by vertical tube systems in clay. Technique and economy.** Modin, B.; Wilen, P. (Chalmers Inst. of Tech., Goeteborg (Sweden). Earth Heat Pump Group). 1985. 37p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. File Number DE86751526.

The most economic type of tubes as to the cost of investment per W and degrees C is the U-shape tube. The best material appears to be polythene, even if the system should not exceed temperatures of 40 to 60 degrees C. At low depth it is profitable to use large tube dimensions. The efficiency is 3 to 4 times higher for a 400 mm tube than for a 20 mm tube vertically placed in a clay of the Gothenburg-type. Material cost is, however, more than 100 times higher for the large tube. The length of holes in clay can be reduced by 65% and in silt by 43% when the temperature in the accumulator is increased by 4 degrees C.

25696 **(PB—86-137775/XAB) Effect of ground water flow on the performance of long-term pipe heat storage in the ground.** Lund, P.D. (Helsinki Univ. of Technology, Espoo (Finland). Dept. of Technical Physics). 26 Aug 1985. 35p. (TKK-F-A—586). NTIS, PC A03/MF E01.

To predict the performance of a pipe thermal-energy storage in the ground, an understanding of the effects of normal and buoyancy-induced ground-water flows is necessary. Using a numerical simulation model able to describe transient three-dimensional heat-transfer phenomena in heterogeneous ground layers, storage-recovery factors for different flow conditions and storage sizes have been obtained covering the range of practical applications.

2508 Chemical

25697 **(AD-A—163094/6/XAB) Survey of alternate stored chemical energy reactions. Annual report, 25 May 1984-25 May 1985.** Cook, L.P.; Plante, E.R. (National Bureau of Standards, Washington, DC (USA). Ceramics Div.). Dec 1985. 109p. (NBSIR—85-3282). NTIS, PC A06/MF A01.

A survey of eight alternative liquid-metal stored chemical energy reactions has been made for purposes of comparison with the lithium-aluminum/water, lithium/sulfur hexafluoride, and other reaction schemes. The objective of this study was to survey the potential of these eight reactions as alternate stored chemical energy systems and to develop priorities for future study. Experimental data on the products of reaction and kinetics of reaction are presented for: Li/H_2O; H_2/O_2), (Li/H_2O; NaO_2/H_2O; H_2/O_2), (MgAl/H_2O; H_2/O_2), and LiAl/ClO_3F). These data were collected using thermogravimetry and Knudsen-effusion mass spectrometry, with x-ray diffraction analysis of experimental products. Among other results, the data show that the aluminum component of the fuels is relatively inert to oxidation up to 650 C. Above this temperature, materials limitations have hampered the collection of experimental data. Thermodynamic analysis has been used to extend the data on each of the eight reaction schemes, and to predict the chemical reaction which best represents the complete oxidation of each fuel by the indicated oxidant at 1100 K. Enthalpies have been calculated for each fuel/oxidant combination. Safety considerations are also discussed for each. Suggestions for future research are given, including suggestions for overcoming the materials problems encountered in this study.

25698 **(PB—86-166667/XAB) Survey of alternate stored-chemical-energy reactions. Annual report, 25 May 1984-25 May 1985.** Cook, L.P.; Plante, E.R. (National Bureau of Standards, Washington, DC (USA). Ceramics Div.). Dec 1985. 107p. (NBSIR—85/3282). NTIS, PC A06/MF A01.

A survey of eight alternative liquid-metal stored-chemical-energy reactions was made for purposes of comparison with the lithium-aluminum/water, lithium/sulfur hexafluoride, and other reaction schemes. The objective of the study was to survey the potential of these eight reactions as alternate stored-chemical-energy systems and to develop priorities for future study. Experimental data on the products of reaction and kinetics of reaction are presented for: (Li/H_2O; H_2/O_2), (Li/H_2O; NaO_2/H_2O; H_2/O_2), (MgAl/H_2O; H_2/O_2), and (LiAl/ClO_3F). These data were collected using thermogravimetry and Knudsen effusion mass spectrometry, with x-ray diffraction analysis of experimental products. Among other results, the data show that the aluminum component of the fuels is relatively inert to oxidation up to 650°s C. Above this temperature, materials limitations have hampered the collection of experimental data. Thermodynamic analysis has been used to extend the data on each of the eight reaction schemes, and to predict the chemical reaction that best represents the complete oxidation of each fuel by the indicated oxidant at 1100 K. Enthalpies were calculated for each fuel/oxidant combination. Safety considerations are also discussed for each.

2509 Batteries

25699 (AD-A—163017/7/XAB) Nickel hydrogen battery cell testing data base: an industry and government survey. Badcock, C.C.; Milden, M.J. (Aerospace Corp., El Segundo, CA (USA). Chemistry and Physics Lab.). 31 Dec 1985. 21p. (TR—0086(6524-04)-1). NTIS, PC A02/MF A01.

Both government and industry were surveyed to determine the level of testing of nickel hydrogen (NiH_2) battery cells and to evaluate the demonstrable capabilities of the couple. Only flight-type cells undergoing ground test were incorporated in the data base; no boilerplate cells or flight batteries were included. Both USAF-design and COMSAT-design cells, as well as a few cells produced by SAFT, were listed. The USAF design is in test in both high and low-earth-orbit simulations, whereas the COMSAT design, intended specifically for high-orbit applications, is being tested predominantly in high orbits. The data from over 400 cells show that the reliability and capability of both designs for high-orbit applications are reasonably established out to ten years in geosynchronous orbit, and to approximately 3000 cycles in other high-orbit applications. However, the data base is weak and incomplete for applications of the USAF cell in low earth orbit. This results from the harsh testing environment to which these cells have been subjected, as well as from various minor design questions that were not resolved when these cells began testing. It must also be pointed out that most of the testing data base is constructed from cells that were developmental in design or manufacture (all cells purchased for a test are used, even if their performance is questionable), as contrasted to a flight program where it can be assumed that many of the failures listed would have been rejected prior either to life test or their use in a flight battery.

25700 (AD-A—163103/5/XAB) Calculated and measured battery voltages - thermodynamics aids in identifying electrochemical reactions. Final report, March-June 1984. DeVries, L.E. (Naval Surface Weapons Center, Silver Spring, MD (USA). White Oak Lab.). Feb 1985. 20p. (NSWC-TR—85-228). NTIS, PC A02/MF A01.

Both the open- and closed-circuit voltages of a battery depend on the thermodynamic conditions inside the cell. When the actual electrochemical reaction of a particular battery is unknown, thermodynamic calculations can help to identify it. Using thermodynamics data, the open-circuit voltages for alternatively electrochemical reactions can be calculated. When accurate data are available, the calculated voltage for the correct electrochemical reaction will agree to within millivolts with the measured value. For the Cl_2-Li molten salt system, the calculated and measured values are both 3.612V. For alkaline zinc batteries, the data indicate that Zn0 is the discharge product at the anode under ambient conditions. For the acid Mn02-Zn system, under the thermodynamic conditions, a two-electron reduction of MnO_2 occurs. Initially, in the alkaline MnO_2-Zn system. $Mn(OH)_4$ is the discharge product at the cathode.

25701 (NP—6751519) Lithium solid state batteries. Knutz, B.C. (Danmarks Tekniske Hoejskole, Lyngby. Fysisk Lab. 3). Apr 1985. 240p. (In Danish). NTIS (US Sales Only), PC A11/MF A01. File Number DE86751519.

The report describes areas where new, high energy density secondary batteries will be able to find large-scale use. Semi-empirical expressions for the open circuit voltage of Lisub(x)TiS_2 as a function of the degree of intercalation x and experimental emf-curves for Lisub(x)TiS_2 at various temperatures are discussed. The discharge of pure and composite intercalation electrodes is described. The behaviour of the composite electrode has been investigated bu simulations. Utilization curves have been calculated as a function of electrode thickness, material parameters, current density and composition of the electrode. On Li/Li_3N/TiS_2-cells diffusion measurements have been made from ambient temperature up to about 170 deg C. The measured values are much lower than the single crystal diffusion coefficient of Li in TiS_2. About 10 times higher values of the diffusion coefficient are obtained when a thin sheet ionically conducting polymer film is inserted between the Li_3N-separator and the TiS_2-electrode. The polymer electrolyte used was $LiCF_3SO_3$ dissolved in polyethylene oxide.The composition of the investigated composite electrodes was mainly 50/50 vol% Li_3N/TiS_2. The experimental discharge curves of a 50/50 vol% Li_3N/TiS_2 composite electrode have been compared with theoretical discharge curves. A Li_3N/TiS_2 composite electrode was cycled 700 times at 140 deg C with a current density of 1.9 mA/cm². The cycling efficiency during the first 300 cycles was 99.87%. The 3-component electrodes show good initial ionic transport, but the reversibility seems to be lower.

25702 Design of thin gap channel flow cells. Edwards, V.; Newman, J. (Materials and Molecular Res. Div., Lawrence Berkeley Lab.; Dept. of Chemical Eng., Univ. of California, Berkeley, CA). pp 578 of Proceedings of the spring 1985 meeting of the Electrochemical Society. Pennington, NJ; Electrochemical Society (1985). (CONF-850542—).

From 167. Electrochemical Society meeting; Toronto, Ontario, Canada (12 May 1985).

A model for predicting the current, concentration, and potential distribution in a thin-gap channel flow cell is presented. The model does not invoke the thin-diffusion layer assumption or the assumption of straight current lines, and it allows for multiple reactions. The model, however, does not include the effect of migration; thus, it is only valid for systems with excess supporting electrolyte. This model can be used for the design and scale-up of channel flow electrochemical reactors.

25703 Thermodynamic properties of liquid Li-Pb, Na-Pb and K-Ph alloys/similarities and differences. Saboungi, M.L.; Ellefson, J. (Argonne National Lab., Argonne, IL). pp 720-1985 of Proceedings of the spring 1985 meeting of the Electrochemical Society. Pennington, NJ; Electrochemical Society (1985). (CONF-850542—).

From 167. Electrochemical Society meeting; Toronto, Ontario, Canada (12 May 1985).

The thermodynamic properties (e.g., activities, activity coefficients, entropies, free energies of mixing) have been determined for liquid Li-Pb, Na-Pb, and K-Pb alloys over the entire composition range. For the two latter systems, a solid electrolyte consisting of either Na-βAl_2O_3 or K-βAl_2O_3 was used in the electrochemical cell which was operated by a standard coulometric titration technique. The results show an unusual composition dependence of the excess chemical potential of the alkali metal. For Li-Pb and K-Pb, a single inflection point is obtained at compositions around 20 and 50 a/o Pb, respectively, while three inflection points are present in the Na-Pb system at about 20, 33, and 50 a/o Pb.

25704 The development and evaluation of aluminum alloy fuels for aluminum/air batteries. Macdonald, D.D.; Lee, K.H.; Moccari, A.; Harrington, D.; Urquidi, M. (SRI International, Menlo Park, CA). pp 777-778 of Proceedings of the spring 1985 meeting of the Electrochemical Society. Pennington, NJ; Electrochemical Society (1985). (CONF-850542—).

From 167. Electrochemical Society meeting; Toronto, Ontario, Canada (12 May 1985).

Various alloys of aluminum containing small additions of zinc, bismuth, tellurium, phosphorous, gallium, indium, and thallium, and combinations of these elements, have been prepared and evaluated electrochemically as possible anode materials for aluminum/air batteries. Some of these alloys have exhibited marked improvement in corrosion resistance over pure aluminum and a commerical alloy, RX-808. Preliminary ac impedance studies in two of the alloys developed in this work indicate that hydrogen evolution and alloy dissolution exhibit markedly different transfer functions, and that these two processes can be delineated by determining the interfacial impedance as a function of applied dc potential.

29 ENERGY PLANNING AND POLICY

25705 (DOE/EIA—0173(85)) Annual Report to Congress 1985. (USDOE Energy Information Administration, Washington, DC). Mar 1986. 64p. NTIS, PC A04/MF A01; 1 - GPO; GPO Dep. File Number DE86007943.

The mission, budget, organization and activities of the EIA are presented. (PSB)

2901 Energy Analysis And Modeling

REFER ALSO TO CITATION(S) 25732, 25738, 25779, 25787, 25788, 25818

25706 (DOE/EIA—0376(83)) State energy price and expenditure report, 1983. (USDOE Energy Information Administration, Washington, DC. Office of Energy Markets and End Use). 18 Feb 1986. 290p. NTIS, PC A13/MF A01 - GPO; GPO Dep. File Number DE86007107.

In 1983, US total energy expenditures in current dollars were $404.9 billion, down 3.7 percent from $420.5 billion in 1982. The downturn in energy expenditures in 1983 represents a reversal of the year-to-year upward trend that occurred in energy expenditures through 1982. Energy expenditures in constant dollars fell even more - 7.3 percent from the 1982 level. In 1983, 68 percent of the money spent on primary energy (i.e., excluding electricity but including the energy consumed by electric utilities) was for petroleum, 23 percent for natural gas, 9 percent for coal, and about 0.6 percent for nuclear fuel. Despite the predominance of petroleum in recent US energy expenditures, gradual change has occurred, as a decreased proportion of the energy bill has gone for petroleum. In 1970, for example, 76 percent of primary energy expenditures were for petroleum, 17 percent for natural gas, 7 percent for coal, and less than 0.1 percent for nuclear fuel.

25707 (Juel-Spez—290) Value tree analysis. A political decision aid. Keeney, R.; Renn, O.; Winterfeldt, D. von; Kotte, U. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Programmgruppe Technik und Gesellschaft). Jan 1985. 101p. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE86751106.

Sozialvertraeglichkeit von Energieversorgungssystemen.

What are the targets and criteria on which national energy policy should be based. What priorities should be set, and how can different social interests be matched. To answer these questions, a new instrument of decision theory is presented which has been applied with good results to controversial political issues in the USA. The new technique is known under the name of value tree analysis. Members of important West German organisations (BDI, VDI, RWE, the Catholic and Protestant Church, Deutscher Naturschutzring, and ecological research institutions) were asked about the goals of their organisations. These goals were then ordered systematically and arranged in a hierarchical tree structure. The value trees of different groups can be combined into a catalogue of social criteria of acceptability and policy assessment. The authors describe the philosophy and methodology of value tree analysis and give an outline of its application in the development of a socially acceptable energy policy. (orig.).

25708 (TVA/ONRED/AWR—85/20) Regional economic input and small area economic analysis. Bohac, C.E. (Tennessee Valley Authority, Knoxville (USA). Office of Natural Resources and Economic Development). Apr 1984. 56p. NTIS, PC A04/MF A01. File Number DE86901137.

The objective of this research was to provide forecasts of the variables necessary to determine possible future levels of regional wood utilization for the TVA region. Second, the research was extended to subregional areas where the impacts that could result from the operation of fuel alcohol plants were estimated along with the impacts of increased use of biomass for residential heating. Long-term demand for forest products is determined by such factors as the future level of contract construction activity and growth in the paper, and lumber and wood industries. For these industries and others, the TVA regional economic simulation model (RESM) was used to produce long-run forecasts of employment, earnings, and gross product. For the subregional analysis, traditional export base multiplier analysis was used for impact estimation. 40 refs., 1 fig., 16 tabs.

2902 Economics And Sociology

REFER ALSO TO CITATION(S) 25343, 25355, 25448, 25495, 25706, 25718, 25729, 25792, 25793, 26766

2903 Environment, Health, And Safety

REFER ALSO TO CITATION(S) 25429, 25534, 25727, 25728, 25766, 25794, 25810, 25811, 25813, 26153, 26256, 26257, 26258, 26259, 26268, 26279, 26280, 26281, 26282, 26316, 26337, 26340, 26341, 26342

25709 (ENEA-RT/STUDI—84-3) Analysis of health risks in energy systems: why and how. Ricci, P.F.; Cirillo, M.C. (ENEA, Rome (Italy). Direzione Centrale Studi Unita Valutazioni Ambientali e Socioeconomiche; Electric Power Research Inst., Palo Alto, CA (USA)). 1982. 11p. (CONF-8210248—1). NTIS (US Sales Only), PC A02/MF A01. File Number DE86900965.

From 10. regional congress of International Radiation Protection Association; Avignon, France (18 Oct 1982).

We discuss risk analysis beginning with those principles of environmental law which are often policy fiat. Measures of risk - risk rates, the expected value, and risk curves - are also discussed to provide a view of some of the issues that commonly arise in energy risk analysis. We conclude that risk analysis is both art and science and that it still requires development. Nevertheless, the use of this type of analysis provides necessary information upon which decision-makers can more accurately choose among technological options.

25710 (PB—86-127321/XAB) Environmental issues related to mineral development in the Stillwater Complex, Mt. Information Circular/1985. Nigbor, M.T.; Iverson, S.R.; Hyndman, P.C. (Bureau of Mines, Denver, CO (USA). Denver Research Center). 1985. 41p. (BM-IC—9040). NTIS, PC A03/MF A01.

This Bureau of Mines publication identifies the significant environmental issues associated with the potential development of strategic and critical minerals in the Stillwater Complex, MT. The Stillwater Complex contains deposits of Cr, platinum-group metals (PGM), and Ni. Issues that must be addressed prior to minerals development include the effects mining, milling, and smelting will have on the land, water, and air, and methods of minimizing the environmental impacts.

2904 Natural Resources

REFER ALSO TO CITATION(S) 25710, 26268

25711 (AD-A—162242/2/XAB) National Defense Stockpile: an organizational perspective. Masters thesis. Batchelor, R.A.; Kirby, J.E. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA). School of Systems and Logistics). Mar 1985. 136p. (AFIT/GSM/LSP—85M-1). NTIS, PC A07/MF A01.

The United States is dependent on foreign sources for many strategic and critical materials vital to its survival and national security. To counter the affects of a disruption in the supply of these materials, the US maintains a National Defense Stockpile (NDS) made up of over a hundred separate depots located in various parts of the country. The management and policy formulation of various aspects of the NDS are distributed across a wide spectrum of agencies in the Executive and Legislative Branches. These organizations along with associated legislation are examined for their impact on the policy-formulation process. This thesis also reviews organizations outside the government that affect stockpile policy. General and specific recommendations on proposed management alternatives are presented at the end of the study.

25712 (PB—86-151560/XAB) Mineral facts and problems, 1985 edition. (Bureau of Mines, Washington, DC (USA)). 1985. 945p. (BM-B—675). NTIS, PC A99/MF A01.

This one-volume encyclopedia comprising 78 commodity chapters and an explanatory introduction contains comprehensive

information on metals and nonmetals. Commodity chapters cover such topics as industry structure, reserves and resources, technology, uses, supply-demand relationships, byproducts and coproducts, strategic considerations, economic and operating factors, problems, and outlook and forecasts to 2000.

2905 Research, Development, Demonstration, And Commercialization

REFER ALSO TO CITATION(S) 25295, 25296, 25378, 25730, 25737

25713 **(DOE/EIA—0204(86/01)) EIA Publications: New Releases.** (USDOE Energy Information Administration, Washington, DC). 18 Mar 1986. 35p. NTIS, PC A03/MF A01; 1 - GPO; GPO Dep. File Number DE86008207.

This is a bimonthly report on the newest available Energy Information Administration (EIA) publications and upcoming reports. It includes news about EIA, as well as many other items of special interest.

25714 **(DOE/EIA—0292(85)) Assessment of the quality of selected EIA data series. Energy consumption data.** (USDOE Energy Information Administration, Washington, DC. Office of Statistical Standards). 2 Apr 1986. 158p. NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE86008899.

Consumption data are assessed in this report, specifically the major energy sources consumed by the residential, commercial, and industrial sectors. Energy sources of importance for all three sectors are natural gas, electricity, distillate, and liquefied petroleum gas (LPG). Because of its importance to industry, coal is also included for the industrial sector. The composite resports are discussed more extensively than the reports based on surveys of end users because thay present conceptual problems that differ from those encountered in the more customary survey reports. The problems are caused by (1) the use of the quality of fuel supplied as a surrogate for the amount consumed and (2) the desire to provide annual estimates by State and by each end-use sector for every energy source, even though some of the source data are avaialable only at more highly aggregated levels, or use different consumer categories. Comparison of the two types of reports indicates discrepancies, and reasons for them are discussed. Discussion also covers the conversion from original units to British thermal unit, which introduces a further question, that of choosing State or national level of disaggregation.

25715 **(DOE/S—0047) International Collaboration in the US Department of Energy's Research and Development programs.** (USDOE Energy Research Advisory Board, Washington, DC. International R and D Panel). Dec 1985. 36p. NTIS, PC A03/MF A01; GPO Dep. File Number DE86007551.

International collaboration was addressed for Magnetic Fusion, Advanced Fission Reactors, Coal Combustion Technology, Synfuels, High-Energy Physics, Nuclear Waste Disposal, and Global Health and Environmental Research. The Panel concluded that collaboration with other countries would yield significant benefits in most of these areas. The report notes that meaningful collaboration is feasible in the liquid metal reactor program. While the Board concurs in this assessment, it wishes to point out that as the United States' program is reduced, foreign interest in its research results will rapidly diminish with time.

25716 **(IC—84/224) Role of computers in developing countries with reference to East Africa.** Shayo, L.K. (International Centre for Theoretical Physics, Trieste (Italy)). 1984. 19p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701443.

The role of computers in economic and technological development is examined with particular reference to developing countries. It is stressed that these countries must exploit the potential of computers in their strive to catch-up in the development race. The shortage of qualified EDP personnel is singled out as one of the most critical factors in any unsatisfactory state of computer applications. A computerization policy based on the demands for information by the sophistication of the development process, and supported by a sufficient core of qualified local manpower, is recommended. The situation in East Africa is discussed and recommendations for training and production of telematics equipment are made.

25717 **(PB—86-124476/XAB) Energy Technology Transfer to China Workshop, April 18-19, 1985. Background papers.** (Office of Technology Assessment (U.S. Congress), Washington, DC). Apr 1985. 201p. NTIS, PC A10/MF A01.

This section addresses a number of issues and concerns that face U.S.-based energy companies that have or will engage in energy technology transfer to the People's Republic of China. From a policy perspective, it is clearly incumbent on the United States government to promote and protect the short and long-term interests of its own energy industries in their commercial dealings with China. It should be kept in mind in this regard that while China's industrial and economic growth rates are somewhat slower than growth rates experienced by Japan in the peak development years, China is ten times the size of Japan, both in terms of population and in terms of resource base.

25718 **(PB—86-142239/XAB) Understanding evaporative cooling. Technical paper.** Rusten, E. (Volunteers in Technical Assistance, Inc., Arlington, VA (USA)). 1985. 49p. (VITA/TP—35:8/85). NTIS, PC A04/MF A01.

The paper provides an introduction to the process of evaporative cooling. In addition, the natural limitations and problems associated with this process, along with some practical applications of evaporative cooling are examined.

2906 Nuclear Energy

REFER ALSO TO CITATION(S) 25380, 25392, 25393, 25614, 25615, 25617, 25618, 26336, 26338, 26339

25719 **(DOE/EIA—0485) Analysis of nuclear power plant construction costs.** (USDOE Energy Information Administration, Washington, DC. Office of Coal, Nuclear, Electric and Alternate Fuels). [1986]. 133p. NTIS, PC A07/MF A01; 1 - GPO; GPO Dep. File Number DE86008419.

The objective of this report is to present the results of a statistical analysis of nuclear power plant construction costs and lead-times (where lead-time is defined as the duration of the construction period), using a sample of units that entered construction during the 1966-1977 period. For more than a decade, analysts have been attempting to understand the reasons for the divergence between predicted and actual construction costs and lead-times. More importantly, it is rapidly being recognized that the future of the nuclear power industry rests precariously on an improvement in the cost and lead-time situation. Thus, it is important to study the historical information on completed plants, not only to understand what has occurred to also to improve the ability to evaluate the economics of future plants. This requires an examination of the factors that have affected both the realized costs and lead-times and the expectations about these factors that have been formed during the construction process. 5 figs., 22 tabs.

25720 **(IFE/KR/E—85/007) Nuclear power - status and development 1984/1985.** Lindgjaerde, R.O. (Institute for Energy Technology, Kjeller (Norway)). Aug 1985. 23p. (In Norwegian). NTIS (US Sales Only), PC A02/MF A01. File Number DE86701444.

A review of the present global position of nuclear power is given. Topics as power-generating capacity, reactor economy, reactor operation experience and waste management are briefly dealt with.

2908 Waste Heat Utilization

25721 **(DOE/PE/70404—H1) Emerging policy issues in PURPA implementation: an examination of policy issues related to federal and state efforts to encourage development of cogeneration and small power production under Title II of PURPA.** (Pfeffer, Lindsay and Associates, Inc., Washington, DC (USA)). Mar 1986. Contract AC01-83PE70404. 334p. NTIS, PC A15/MF A01; 1; GPO Dep. File Number DE86008845.

Purpose of this study is to examine the results of FERG and state efforts to encourage the development of cogeneration and small power production under Title II of the Public Utility Regualtory Policies Act of 1978 (PURPA) in the years since the statute was enacted. The frame of reference specified by DOE for use in this study includes both the original purposes of the legislation as set forth in PURPA and the current overall energy policy goal which is to "foster an adequate supply of energy at reasonable costs." This review of PURPA implementation efforts is designed to assess the results to date in terms of achieving the stated goals of the statute (including "to encourage cogeneration and small power production"), identify perceived areas of conflict between federal and state efforts to maximize development of qualifying facilities (QFs) and current Administration concerns for achieving greater levels of economic efficiency in electric power supply, briefly examine the nature of such conflicts, with reference to specific cases wherever possible, and suggest possible means of conforming government efforts to encourage QF development with the economic efficiency objectives underlying national energy policy.

25722 **(PB—86-144037/XAB) Characterization of commercial and multi-family residential cogeneration markets and applications. Final report, August 1982-August 1984.** Cummings, C.R.; Dobyns, J.E.; Celentano, D.L.; Botkin, H.C. (Science Applications International Corp., La Jolla, CA (USA)). Aug 1984. 223p. (SAI—84-1176). NTIS, PC A10/MF A01.

The project was initiated to assist GRI in focusing its cogeneration project R & D efforts on those areas where the greatest benefits can be achieved. Three separate tasks were performed. First, a statistical analysis of all cogenerator applications for Qualifying Facility status was completed. Second, the owners or operators of 43 small, on-line cogeneration projects were contacted and interviewed to identify typical or recurring problems. Third, ten market sectors were characterized on a technical and institutional basis regarding compatibility and feasibility for cogeneration.

2910 Conservation

REFER ALSO TO CITATION(S) 25753, 25754, 25761, 25788, 25792, 25793, 25794, 25795, 25798, 25816

2920 Supply, Demand, And Forecasting

REFER ALSO TO CITATION(S) 25333, 25342

25723 **(DOE/EIA—0149(85)) EIA Publications Directory 1985: a user's guide.** (USDOE Energy Information Administration, Washington, DC). 19 Mar 1986. 110p. NTIS, PC A06/MF A01; 1 - GPO; GPO Dep. File Number DE86008417.

Since October 1977, the Energy Information Administration (EIA) of the US Department of Energy has been responsible for collecting and publishing statistical data on energy production, consumption, prices, resources, and projections of supply and demand. EIA Publications Directory: A User's Guide provides access to EIA publications. The Publications Directory, published by the National Energy Information Center, is used by federal agencies, state and local governments, libraries, energy-related organizations, and the general public. This issue contains abstracts of publications released by EIA for printing in 1985. The Publications Directory lists all 1985 EIA publications by subject, title, and report number; it also explains how to order these publications. The abstracts of the publications are arranged by broad subject categories such as coal, petroleum, natural gas, and energy planning and policy. These categories are further divided. For example, the petroleum category is divided into reserves, drilling and production, processing petroleum products, and marketing and economics. Information about EIA publications, products, and services may be obtained by writing to the National Energy Information Center, EI-20, Energy Information Administration, Forrestal Building, Washington, DC 20585, or by calling (202) 252-8800. EIA publications may also be accessed at Federal Depository Libraries or obtained by using the order forms in the back of this volume.

25724 **(DOE/NBM—6008055) May 1979 power outlook through 1989-1990.** (USDOE Bonneville Power Administration, Portland, OR). 1979. 17p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86008055.

A 10-year planning forecast for the Pacific Northwest Region is presented. Greatest potential for power deficits were targeted for 1985-86 time frame.

25725 **(NP—6900413) Energy scenarios and their environmental consequences.** (Mitre Corp., Bedford, MA (USA)). [1986]. 129p. NTIS, PC A07. File Number DE86900413.

The objective of this paper is to compare four boundary condition supply scenario for satisfying future energy demand in the period 1970 to 2000. These comparisons describe in a first side sense the range of energy supply options, and associated environmental and economic costs, which can potentially be pursued by the nation during the remainder of the century. Specifically this comparison describes the effluent loading, cost, and efficiency associated with each option and defines the environmental R & D needs and policy initiatives required for the achievement of each option as a function of time for coal, petroleum, and nuclear power.

2930 Policy, Legislation, And Regulation

REFER ALSO TO CITATION(S) 25380, 25508, 26268

2940 Fossil Fuels

REFER ALSO TO CITATION(S) 25271, 25295, 25296, 25299, 25333, 25336, 25338, 25339, 25341, 25342, 25343, 25344, 25350, 25354, 25355

25726 **(DOE/EIA—0035(85/12)) Monthly energy review, December 1985. 1985 Annual data and summaries.** (USDOE Energy Information Administration, Washington, DC. Office of Energy Markets and End Use). 26 Mar 1986. 136p. NTIS, PC A07/MF A01; 1 - GPO; GPO Dep. File Number DE86008509.

US energy production during 1985 was 64.7 quadrillion British thermal units (Btu), 1.4% below the record level attained in 1984. US consumption of energy totaled 73.8 quadrillion Btu, about the same as in 1984 but well below the 78.9 quadrillion Btu consumed during the peak year of 1979. Net imports of energy fell from 9.0 quadrillion Btu in 1984 to 7.8 quadrillion Btu in 1985, a 12.8% decline that brought net imports to the second lowest level since the 1973-1974 oil embargo. Net imports remained significantly below the all-time high of 18.0 quadrillion Btu reached in 1977.

25727 **(GAO/NSIAD—85-91) Hazardous waste management at Tinker Air Force Base. Problems noted, improvements needed.** (General Accounting Office, Washington, DC (USA). National Security and International Affairs Div.). 19 Jul 1985. 31p. General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760. File Number TI86900609.

Report to The Chairman, Subcommittee on Environment, Energy and Natural Resources, Committee on Government Operations, House of Representatives.

Tinker Air Force Base, Oklahoma, as a major military industrial installation, is a large generator of hazardous waste. At the request of Chairman Mike Synar, GAO reviewed Tinker's efforts to manage and dispose of its hazardous waste. GAO found that Tinker: (1) sold, transferred, or disposed of waste oils, fuels, and solvents rather than the preferred method of recycling and reusing

them; (2) underused and poorly managed its industrial waste treatment plant; (3) experienced problems with its hazardous waste disposal contractors; and (4) was deficient in complying with Environmental Protection Agency regulations implementing the Resource Conservation and Recovery Act of 1976, as amended. GAO recommends specific actions to correct these problems.

25728 **(NP—6901117) Coal transportation infrastructure in India.** Ahuja, D.; Banerjee, A.N. (Ministry of Industries, New Delhi (India). Bureau of Industrial Costs and Prices). 1983. 26p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86901117.

In India, coal is moved by rail, trucks, belts, ropeways and coastal shipping. Of these, rail and road account for about 95% of the movement. Railways are by far the most important carriers, accounting for over two-thirds of the coal transported. About 1.5% moves by ships in addition to movement by rail. Trends in coal dispatches between 1979 and 1982 are given.

25729 **(PB—86-141736/XAB) Oil revenues and economic policy in Cameroon: results from a computable general-equilibrium model. World Bank staff working paper.** Benjamin, N.C.; Devarajan, S. (International Bank for Reconstruction and Development, Washington, DC (USA)). 1985. 60p. (WP—745). NTIS MF A01.

The paper analyzes the impact of oil revenues on the agriculture-based economy of Cameroon, a significant (100,000 barrels per day) but temporary (20 years of reserves) oil producer. It has been observed in other oil-exporting countries that when oil revenues are spent domestically, an appreciation of the real exchange rate results, leading to a shift in the production mix away from tradeable sectors in favor of nontradeables. Using a multisectoral, general-equilibrium model of Cameroon, the authors show that while this effect occurs in the aggregate, some tradeable sectors actually expand.

25730 **Summary of AR & TD/APT contracts and grants supported by the Office of Fossil Energy FY84.** Pittsburgh, PA; Pittsburgh Energy Technology Center (1985). 301p.

Summaries are listed of research contracts and grants supported by the Office of Fossil Energy in FY84 under the following two programs: advanced research and technology development (AR & TD), for coal; and advanced process technology (APT), for oil, tar sands, shale oil and unconventional hydrocarbons. The summaries consist of one-page fact sheets for each contract or grant providing business information, research objectives, statement of work and major accomplishments.

2960 Electric Power

REFER ALSO TO CITATION(S) 25534, 25724, 25786, 25788, 25789

25731 **(DOE/EIA—022(86/01)) Electric Power Monthly, January 1986.** (USDOE Energy Information Administration, Washington, DC. Office of Coal, Nuclear, Electric and Alternate Fuels). 7 Apr 1986. 44p. NTIS, PC A03/MF A01 - GPO; GPO Dep. File Number DE86009118.

During January 1986, net generation by electric utilities in the United States was 217,735 gigawatthours. On a year-to-date basis, net generation at the end of January 1986 was 4.4% lower than for the same period in 1985. In January 1986, coal accounted for 59.7% of all electricity produced, petroleum for 5.1%, gas for 8.0%, hydroelectric power for 10.0%, nuclear power for 16.6%, with the remaining 0.5% from geothermal, wood, wind, waste, and solar.

25732 **(EFN—17) Efficient use of electricity - research and development. A working paper of the investigation into electric power and indigenous fuels (ELIN).** (Energiforskningsnaemnden, Stockholm (Sweden)). Jun 1985. 105p. (In Swedish). NTIS (US Sales Only), PC A06/MF A01. File Number DE86751528.

In this study the concept 'efficient use of electricity' covers four different ways to influence the electricity use: - use of more efficient apparatuses and equipment; - substitution of fuels by electricity; - substitution of electricity by other energy carriers; - adaptation of electricity demand to supply. The main part of the surveyed R and D projects are not directly motivated by the phasing out of nuclear power. Only a few projects have this background, mainly projects on electrical space heating and some systems studies. Results from R and D are important inputs while deciding on technologies, systems, policy instruments etc. that can be introduced and used in the energy system. It is also important for the Government to support the establishment and development of basic knowledge and competence at universities. The study and the report are divided into the sectors which are common in energy policy, statistics and R and D-programmes (industry, residential and commercial, transportation, electricity supply, and transmission). The R and D, competence etc in each sector are described. (A list of projects is attached as an appendix). Conclusions and proposals are presented. Some of the major conclusions are: - increased emphasis on efficient use of electricity in the planning; - increased Governmental support to research, especially at universities, on electricity use in industry, especially electroheating and power electronics; - increased Governmental support to research and demonstration on old houses with electrical space heating; - continued Governmental support to independent energy systems studies; - complementary Governmental support to systems studies on power variation during the year and load management; - increased Governmental support to universities for education and research in electrical power systems; - Governmental support to demonstration of small-scale cogeneration power plants.

25733 **(NP—6751454) Quarterly report on the electric power industry in the Federal Republic of Germany. 2. quarter 1985. Power generation in publicly-owned electric utilities, the industrial independent units and the Federal Railways and overall power consumption in the Federal Republic of Germany.** (Bundesministerium fuer Wirtschaft, Bonn (Germany, F.R.)). 1985. 12p. (In German). NTIS (US Sales Only), PC A02/MF A01. File Number DE86751454.

Tables are presented on origins and consumption of electric power, power generation by public utilities, independent industrial plants and by the Federal Railways, development of power consumption from the public supply network in the federal states, net power generation and consumption of the industry, and development of the gross power generation in utility-owned power plants and independent industrial plants in the federal states.

25734 **(NP—6901120) Data system in the Indian power sector. Discussion paper No. 04-84.** Ramesh, S. (Tata Energy Research Inst., New Delhi (India)). Mar 1984. 43p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86901120.

While a very large volume of data is collected, transmitted and analysed at different levels, there is still need for considerable modifications and improvements at the various points. Some of these required improvements have been touched upon in this paper. First, there is an urgent need to strengthen the data-processing facilities of the State Electricity Boards. The present gap in the facilities between the SEBs and the central organizations, needs to be narrowed down. Second, the data collected at different levels should be re-examined in order to ensure that unnecessary information is not collected, and the periodicity is not more frequent than justified. This would result in reducing the data collection requirements in some areas. Third, there are certain impediments to efficient and correct data collection resulting from inadequate technical arrangements, such as unmetered power supply to agriculturists for their private tubewells/pumpsets.

25735 **(NP—6901121) Mariginal cost based tariffs in Indian power sector. A critical review. Discussion paper No. 07.83.** Bhattacharaya, A. (Tata Energy Research Inst., New Delhi (India)). 1986. 35p. NTIS, PC A03/MF A01;1. File Number DE86901121.

An electric utility is aimed at constructing sufficient generating capacity to meet its demand over the planning horizon. This capacity will usually include a mix of baseload, intermediate and peaking plants. The generation mix and the resulting capital costs of a system constructed to serve only the peak would be quite dif-

ferent from a system constructed to serve load patterns the utilities commonly experience. The objective of the present paper is to provide a framework which will aid the planner at utility level in the understanding of marginal methodology to conduct time-differentiated marginal cost based tariffs. A logical framework is developed to analyse the three parameters of cost causation: capacity, energy and customers, in consonance with existing literature. Additionally, the paper translates the principles of cost causation, the paper tariffs with the help of a available data for nine State Electricity Boards (SEBs).

25736 **(PB—86-125325/XAB) Toshiba Review, Vol. 40, No. 11, 1985.** (Toshibe Corp., Tokyo (Japan). Principal Office). 1985. 100p. NTIS, PC A04/MF E01.

Contents include: special issue on upgrading the renewal of steam power plants; techniques for improving steam-turbine efficiency; ways of prolonging steam-turbine life; improvement of heat exchangers for fossil-fuel power stations; life prolongation and performance elevation for electric apparatus in steam power plants; diagnostics on steam power plants; modernization of steam power plant control systems; the latest application of digital control systems to fossil-fired power plants; support systems for engineering and office work in power stations; and general features on other equipment.

25737 **Trends in electric utility research.** Bullard, C.; Womeldorff, P. Elmsford, NY; Pergamon Press (1984). 500p. Pergamon Press, Fairview Park, Elmsford, NY 10523.

This volume identifies those research needs, results and interaction processes affecting the electric utility industry. Experts report on research results and their relevance to the industry; identify problems faced by electric utilities and outline needs for future research to address these problems; and describe successful universities. Contents (partial): Environment and public health research. Materials and metallurgical problems in power plants. Load management and effective use of control systems. Applications for coal use including fluidized bed combustion. Alternative energy studies including cogeneration and district heating. Effects of regulatory policies. Utility economics and the future use of nuclear power.

2980 Consumption And Utilization

REFER ALSO TO CITATION(S) 25337, 25714, 25723, 25726, 25786, 25787, 25789

25738 **(NP—6751521) Energy in Sweden.** (Statens Energiverk, Stockholm (Sweden)). Jul 1985. 16p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86751521.

The National Energy Administration (Statens Energiverk) is the national energy authority in Sweden. One of its important tasks is to supply information about the energy situation, viz developments and forecasts regarding energy use, the state of energy research, current assessment of oil prices etc. To this end, the Administration issues a publication entitled Energy in Sweden 1985. The present booklet is an adapted and translated version of that publication, addressed to those who may be interested in following energy development in Sweden.

2990 Unconventional Sources And Power Generation

REFER ALSO TO CITATION(S) 25470, 25494, 25495, 25499, 25508, 25511, 26250

25739 (KFK-PEF—2, pp 581-595) **Economic and political effects and repercussions of forest dieback.** Niesslein, E. (Freiburg Univ., Germany, F.R. Inst. fuer Forstpolitik und Raumordnung). Apr 1985. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86751479. (CONF-8503225—).

From 1. status colloquium of the European Research Center project for air pollution abatement measures (PEF) of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (5 Mar 1985).

Conversion of forest-damage inventory figures into timber-market-relevant data revealed that, at present, the wood mass of severely affected trees (needle loss over 60%) and of dead trees is 162% of annual trunk-wood fell in spruce. When dynamizing this percentage by means of available time series, present-time annual increase of severely affected and dead spruce is over 50% of annual trunk-wood fell: the dimension of forced utilization for silvicultural reasons will indeed be much greater if these trees have to be actually cut for crop. There are no silvicultural studies on purposeful utilization methods and expectable crop quantities available.

30 DIRECT ENERGY CONVERSION

25740 **(PB—86-901700/XAB) Government research and development summaries: electrical project briefs. Monthly report.** (Interagency Advanced Power Group, Fort Belvoir, VA (USA)). 1986. vp. NTIS.

Electrical project briefs report active R and D energy conversion to electrical forms (including electrical energy control) by electromechanical, electromagnetic, electrostatic, magnetohydrodynamic, electronic, and solid state devices, excluding photovoltaic and photoemissive devices. Specific attention is devoted to magnetohydrodynamics, power conditioning, and superconductivity.

3001 Mhd Generators

25741 **(DOE/ET/10815—113) [University of Tennessee Space Institute energy conversion programs]. Quarterly technical progress report, July-September 1985.** (Tennessee Univ., Tullahoma (USA). Space Inst.). Mar 1986. Contract AC02-79ET10815. 63p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE86008924.

In this Quarterly Technical Progress Report, UTSI reports on progress in developing the steam bottoming plant components for potential application to an MHD steam power plant. The report includes results of two tests. LMF4-B and -C, in the DOE Coal Fired Flow Facility (CFFF). Performance parameters are reported for the 45° Diagonal Conducting Wall MHD generator for sixteen different test conditions. Particulate size and loading data are included before clean-up and after the baghouse. Additional fouling data are reported for the convective heat transfer surfaces. Bulk heat transfer and heat transfer coefficients for the test section tubes are included. Performance of the refractories and heat transfer probes are discussed. A status report on the use of advanced diagnostics equipment by both UTSI and Mississippi State University (MSU) in support of CFFF testing is presented. Finally, results of experimental work directed toward maximum recovery of the potassium seed in the MHD system are discussed. 1 ref., 30 figs., 2 tabs.

25742 **(DOE/ET/15614—22-Pt.1) MHD generator component development, Part 1. Final report, 1 October 1979-31 January 1985.** (Avco-Everett Research Lab., Everett, MA (USA)). Feb 1985. Contract AC22-80ET15614. 446p. NTIS, PC A19/MF A01; 1; GPO Dep. File Number DE86007357.

This is the final report of work performed by Avco Everett Research Laboratory, Inc. (AERL) for the US Department of Energy, Pittsburgh Energy Technology Center, under Contract No. DE-AC22-80ET15614. The total period of performance extended from October 1, 1979 to January 31, 1985 although the analytical and experimental work was completed in April 1984. The overall objectives of the program were: (1) contribute, by appropriate systematic experimental and analytical investigations, to the engineering data base necessary for the design and construction of magnetohydrodynamic (MHD) generators at the Component Demonstration and Integration Facility (CDIF) scale of 50 thermal megawatts (MW/sub th/) and the baseload scale of 2000 MW/sub th/; and (2) design and fabricate specific hardware items to be tested at the CDIF site in Butte, Montana. The program consisted of a series of related tasks, which are described in subsequent sections of this report. Section 2.0 summarizes the important results of the entire program. Sections 3.0 through 7.0 describe the work in detail, and are organized as follows: Section 3.0, MHD Channel Design and Performance, reports experimental and analytical investigations related to MHD channel design and performance. This work includes a comparison of Mk VI channel operation using ash-

injected, oil-fired combustors (AIC), with channel operation using the coal combustor provided, through DOE/MHD, by TRW, Inc. 72 refs., 221 figs., 30 tabs.

25743 **(DOE/ET/15614—22-Pt.2) MHD generator component development. Part II. Final report, 1 October 1979-31 January 1985.** (Avco-Everett Research Lab., Everett, MA (USA)). Feb 1985. Contract AC22-80ET15614. 461p. NTIS, PC A20/MF A01; 1; GPO Dep. File Number DE86007358.

Significant progress was made in extending the lifetime and reliability of MHD channels. The greatest engineering emphasis was placed on the development of long-duration anodes because they represented the life limiting component of the channel. Slagging anodes are especially vulnerable to electrochemical corrosion because negative ions of oxygen and sulfur are driven by the electric field into the slag and onto the metal electrode surfaces on the anode wall. Likewise, interelectrode faults in the form of arcs are driven by the Lorentz force (J x B) into the anode wall where structural damage may occur. On the cathode side of the channel, both negative radicals and interelectrode arcs are forced away from the wall and into the plasma. Cathodes, protected by the favorable direction of the electric field, are, for all practical purposes, immune to sulfur, oxygen, and interelectrode arcs. Cathodes of copper and tungsten-copper caps have been operated for durations of 600 h. The performance of the CDIF 1B2 CCDF generator was investigated analytically. The power shufflers of the CCDF generator, in addition to suppressing the axial current of the uncontrolled diagonal generator, also altered the off-design flow characteristics of the generator. The criteria for the selection of the design operating point and the loading adjustments for part-load conditions are discussed. The feasibility of operating with a midchannel power tap in the 1B2 CCDF generator was considered. 52 refs., 226 figs., 45 tabs.

25744 **(DOE/ET/15614—22-Pt.3) MHD generator component development. Part III. Final report, 1 October 1979-31 January 1985.** (Avco-Everett Research Lab., Everett, MA (USA)). Feb 1985. Contract AC22-80ET15614. 316p. NTIS, PC A14/MF A01; 1; GPO Dep. File Number DE86007359.

The MHD test facilities are designed to support development of channels that will demonstrate both durability and reliability under realistic operating conditions. The burner-channel-diffuser flow trains used have been designed to operate at mass flows of up to 6 lb/sec and to produce electrical power in excess of 500 kW. This permits observation of long-duration effects for which any internal problems would visibly affect performance and produce physical damage. Several burners, channels, and diffusers exist and can be mated in various combinations. The original version of the contract called for the design, fabrication, and delivery of the following test hardware to the DOE Component Demonstration and Integration Facility (CDIF): 1A2 MHD channel, 1B2 MHD generator, 1B3 MHD generator, 1B ash-injected combustor, and electrode current-control and consolidation circuits for the 1A and 1B channels. The 1A1 MHD generator and 1A ash-injected combustor were delivered to the CDIF on a prior contract. The 1A2 channel is interchangeable with the 1A1 and identical to it except for the addition of platinum caps on the anodes to provide duration capability for a 500 hr demonstration test. Both A channels are constructed of separable sidewalls containing three-segment diagonal bars, a geometry that permits loading in either the Faraday or two-terminal diagonal configuration.

3003 Thermoelectric Generators

25745 **(GEPP-TIS—892) Characterization of the impurities in tungsten/silicon-germanium contacts.** Gregg, H.A. Sr. (General Electric Co., Largo, FL (USA). Neutron Devices Dept.). 26 Mar 1986. Contract AC04-76DP00656. 17p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86008791.

Secondary ion mass spectrometry and Auger electron spectrometry depth profiling were used to determine impurity distributions in sputter deposited tungsten films over N-type and P-type 80/20 silicon-germanium elements of thermoelectric devices. These analyses showed that silicon, oxygen, sodium, boron, and phosphorous were present as impurities in the tungsten film. All these impurities except oxygen and sodium came from the substrate. Oxygen was gettered by the tungsten films, while sodium was possibly the result of sample handling. Further, the results from this study indicate that an oxide build-up, primarily at the tungsten/silicon-germanium interface of the N-type materials, is the major contributor to contact resistance in thermoelectric devices.

3005 Fuel Cells

REFER ALSO TO CITATION(S) 25803, 25849

25746 **X-ray absorption spectroscopy studies of electrocatalysts.** O'Grady, W.E.; Sayers, D.E.; Budnick, J.I.; Hayes, G.H. (Brookhaven National Lab., Upton, NY). pp 895-896 of Proceedings of the spring 1985 meeting of the Electrochemical Society. Pennington, NJ; Electrochemical Society (1985). (CONF-850542—).

From 167. Electrochemical Society meeting; Toronto, Ontario, Canada (12 May 1985).

Using x-ray absorption spectroscopy, it has been possible to probe the in situ structure of an operating fuel-cell electrode. Both x-ray absorption near-edge structure (XANES) and extended x-ray absorption fine structure (EXAFS) data have been used to obtain structural information on carbon-supported platinum electrodes. Further, it has been possible to observe the aging of electrodes using x-ray absorption spectroscopy.

25747 **Transport through membranes: The effect of electroactive species and electrolyte.** Leddy, J.; Vanderborgh, N.E. (Los Alamos National Laboratory, Los Alamos, NM). pp 444 of Proceedings of the spring 1985 meeting of the Electrochemical Society. Pennington, NJ; Electrochemical Society (1985). (CONF-850542—).

From 167. Electrochemical Society meeting; Toronto, Ontario, Canada (12 May 1985).

Contemporary fuel cells use membrane separators as a medium for proton transport. The charge density and dimensions of the membrane's pores influence molecular transport. The effects of these two parameters were separated by examining three types of membranes: membranes with given pore diameters (0.01-0.8 μm) and no affixed ion exchange groups; similar membranes with bound exchange groups; and prefabricated membranes, such as poly(perfluorosulfonic acid). The charge and size of both the electroactive species and the electrolyte influenced transport.

25748 **Current voltage surface mapping of solid polymer electrolyte cell electrodes using microelectrode arrays created by photolithography.** Rieke, P.C.; Vanderburgh, N. (Los Alamos National Lab., Los Alamos, NM). pp 709 of Proceedings of the spring 1985 meeting of the Electrochemical Society. Pennington, NJ; Electrochemical Society (1985). (CONF-850542—).

From 167. Electrochemical Society meeting; Toronto, Ontario, Canada (12 May 1985).

Inhomogeneous current distribution in solid polymer electrolyte fuel cells detracts from the efficiency of such systems. This inhomogeneity can be studied by using an array of reference and counterelectrodes to control and measure the current voltage characteristics across the fuel cell anode and/or cathode. Conventional photolithography was used to create the arrays of electrodes on the polymer. Pt, Pd, and Ag were tested as counter and reference electrodes. Anodized aluminum, $Al_2O_3Si_3N_4$, and SiO_2 were tested as insulators for the electrical leads to each electrode.

25749 **Kinetic studies using a rotating disk electrode: I electron transfer rates in ferrous/ferric sulfate.** Morrison, B.; Striebel, K.; Andricacos, P.; Ross, P.N. (Lawrence Berkeley Lab., Materials and Molecular Res. Div., Univ. of California, Berkeley, CA 94720). pp 702-703 of Proceedings of the spring 1985 meeting of the Electrochemical Society. Pennington, NJ; Electrochemical Society (1985). (CONF-850542—). Contract AC03-76SF00098.

From 167. Electrochemical Society meeting; Toronto, Ontario, Canada (12 May 1985).

Kinetic studies with newly synthesized electrolytes for fuel cells must usually be performed with very small quantities of impure material. The rotating disk electrode (RDE) method usually employed for kinetic studies has some inherent limitations when applied to such materials due to the relatively large volume of electrolyte required. The rotating cylinder electrode (RCE), configuration has the advantage of a much lower electrolyte volume. However, the RCE has not been used previously in kinetic studies, so there is no established practice for extracting kinetic currents from rotation-rate dependent currents. In this paper, the authors report the RCE results for electron transfer rates for Fe^{3+}/Fe^{2+} in supporting acid sulfate electrolyte and compare these to the RDE results in the same electrolyte.

25750 **Effect of polymer morphology on proton and water transport through ionomeric polymers.** Fales, J.L.; Springer, T.E.; Vanderborgh, N.E.; Stroeve, P. (Los Alamos National Lab., Los Alamos, NM). pp 596 of Proceedings of the spring 1985 meeting of the Electrochemical Society. Pennington, NJ; Electrochemical Society (1985). (CONF-850542—).

From 167. Electrochemical Society meeting; Toronto, Ontario, Canada (12 May 1985).

Ion-exchange processes within polymer membranes used as fuel cell separators involve both ionic e.g., protonic, and molecular, e.g., water transport steps. Improved mathematical formulations are described that were developed following a synergistic modeling-experimental approach. Of special interest is the effect of polymer swelling and the resulting alteration of pore geometries, on transport parameters as well as the effect of surface charge on discrete ionic distributions. A comparison of these calculations with experimental results is presented.

25751 **C_1 chemistry on metal phthalocyanine electrocatalysts.** Linkous, C.A. (Brookhaven National Lab., Upton, NY). pp 939 of Proceedings of the spring 1985 meeting of the Electrochemical Society. Pennington, NJ; Electrochemical Society (1985). (CONF-850542—).

From 167. Electrochemical Society meeting; Toronto, Ontario, Canada (12 May 1985).

A number of tetrasulfonated metal phthalocyanines (VO, Cr, Mn, Fe, Co, Ni, Cu, Zn, Ga, and Ru) were synthesized and tested as to their ability to catalyze various C, reactions of interest. Among these were CO_2 reduction, for the purpose of chemical energy storage, and CO as well as CH_3OH oxidation, for possible direct use in fuel cells. Voltammetric response varied according to the nature of the metal center. The Fe, Ru, Cu, and Ga macrocycles showed a response to CO, while all of them gave a response toward CO_2 in alkaline media, where corbonate species were generated.

25752 **Mass transfer enchancement by small obstacles in an electrochemical flow cell.** Fischl, D.S.; Muller, R.H.; Tobias, C.W. (Materials and Molecular Research Div., Lawrence Berkeley Lab. and Dept. of Chemical Eng., Univ. of California. Berkeley, CA). pp 579-580 of Proceedings of the spring 1985 meeting of the Electrochemical Society. Pennington, NJ; Electrochemical Society (1985). (CONF-850542—). Contract AC03-76SF00098.

From 167. Electrochemical Society meeting; Toronto, Ontario, Canada (12 May 1985).

Most transfer enhancement by square (0.76 mm) rod-shaped nonconducting obstacles attached to the cathode was investigated in an electrolytic flow cell of 5 x 5 mm cross section and 508 mm length. Flow patterns were visualized and photographed. Effectiveness was evaluated for different obstacle spacings by measuring pressure drops and limiting currents for the reduction of ferricyanide, in the range of $80 \leqq Re \leqq 3200$. At a given flow rate as much as a fourfold increase of the mass transfer rate was observed, with a power demand for pumping as little as one-thirtieth of that required for achieving the same transport rate in the absence of obstacles.

32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION

REFER ALSO TO CITATION(S) 26769, 26770, 26771

3201 Buildings

REFER ALSO TO CITATION(S) 25491, 26018

25753 **(AD-A—162932/8/XAB) Why a network energy-monitoring and control system. Master's thesis.** Barron, R.B. (Scientists' Inst. for Public Information, New York (USA)). 1985. 155p. NTIS, PC A08/MF A01.

By installing control instructions in a computer and connecting it to each piece of equipment, a building facility operator can use the computer to consistently implement control strategies pertaining to utility consumption. This essentially is what is known as an Energy Monitoring and Control System (EMCS). Typically, the building owner insists that the reduction in utility costs after the few years exceeds, or pays back, the installation cost of the EMCS. Due to the high cost of minicomputer equipment, early systems could only have one computer that was remoted through a communications network to many nearby buildings. However, inexpensive but capable microcomputers are available that can provide control for a single building. This report explores the desireability and cost of an EMCS system in general and of these two alternatives in particular. It is found that the quickest payback was found in systems implementing the fewest number of control strategies. Further, it appears that choice of a network over a single building control system depends on the number of buildings connected.

25754 **(AD-A—163295/9/XAB) Navy activity-level energy systems planning procedure (A-LESP) users manual.** (Department of the Navy, Washington, DC (USA)). 1986. 375p. NTIS, PC A16/MF A01.

A-LESP is an evaluation procedure to rapidly identify and evaluate large numbers of energy conservation options. The options are defined in the Energy Conservation Opportunity (ECO) and Energy System (ES) sections of the manual. Evaluation of the energy options is accomplished in a three-step process: (1) Identify representative facilities/systems at the activity. As each facility identified, the feasibility of applicable energy options is evaluated, with feasible options listed for further consideration. (2) Establish the economic viability of the feasible options by using a simplified version of the savings to investment ratio(SIR) in which the present worth of the savings in energy operation and maintenance is divided by the present worth of the cost of the project. A method for determining this ratio is included with each energy option. and (3) Establish energy goal categories and funding sources for economically viable energy options ($SIR > 1$). The ECOs are functionally grouped into six sections: Building envelope; Distribution; Heating, ventiliation and air conditioning, Hot water, Lighting; and Equipment. The ESs are functionally grouped in three sections: Cogeneration; Steam; and Electric.

25755 **(BFR-R—108-1985) Testing of hermetical piston- and rotary-compressors.** Loefstedt, J. (Statens Raad foer Byggnadsforskning, Stockholm (Sweden)). 1985. 81p. (In Swedish). NTIS (US Sales Only), MF A01. File Number DE86751538.

The performance of two hermetical heat pumps have been tested. Operational data have been collected with a calorimeter. The test have been performed at stationary operating conditions. The compressors have been tested at a number of different evaporating temperatures with constant condensing temperatures at 30, 40, 50, and when possible at 60 degrees C. The effect of overheating on performance has been investigated at a condensing temperature of 40 degrees C and an evaporation temperature of - 5 degrees C. R 22 and R 502 have been used as refrigerants. The results obtained have been compiled with corresponding data from earlier tests. The tests show a tendency towards higher efficiency for the new heat pump models. With 42 diagrams. 4 refs.

25756 **(BFR-R—110-1985) Influence of intermittent operation on heat pump effectivity. Computer model.** Bergman, A. (Statens Raad foer Byggnadsforskning, Stockholm (Sweden)). 1985. 51p. (In Swedish). NTIS (US Sales Only), PC A04/MF A01. File Number DE86751539.

This report presents a computer program produced in connection with the development of dynamic laboratory testing methods for heat pump operation. The program can simulate operation of a chosen heat pump unit under varying time and temperature conditions. The effects of various parameters such as house size, thermal masses, radiator system on energy consumption and the heat pump coefficient of performance can be studied. The program gives an opportunity to compare test situations and simulation and thereby means to evaluate hypotheses concerning heat pump operation.

25757 **(BFR-R—111-1985) Influence of intermittent operation on heat pump effectivity. Laboratory tests.** Bergman, A. (Statens Raad foer Byggnadsforskning, Stockholm (Sweden)). 1985. 70p. (In Swedish). NTIS (US Sales Only), PC A04/MF A01. File Number DE86751540.

The aim of this project has been to develop dynamic laboratory testing methods for calculation of energy savings and the coefficient of performance for heat pump systems. All operating cases occurring under various climatic conditions during the year simulated in the laboratory. One air source heat pump and one ground source heat pump have been tested. The effects of intermittent operation and choice of control strategy have been studied. The result show that the effects of intermittent operation can be neglected. Reductions of the coefficient of performance are caused by heat losses during pauses in heat pump operation. Methods for determination of these heat losses are discussed in the report.

25758 **(BFR-R—116-1985) Dependence of the built environment energy budget on climate. Data and methods of calculation.** Taesler, R. (Statens Raad foer Byggnadsforskning, Stockholm (Sweden)). 1985. 124p. (In Swedish). NTIS (US Sales Only), PC A06/MF A01. File Number DE86751525.

The objective of this project showed the development of climatic data for calculation of energy consumption in the built environment with respect to local wind, temperature and isolation conditions. Investigation of the effect of local factors (including urban factors) on energy requirements of the built environment. The method of working and computer program for frequency tables of conjoined variations in wind and temperature, printed tables for 35 sites and local conversion of wind and temperature data. Working methods for simplification and graphic presentation of jointly varying climatic data. Production of a model for calculation of local insolation (direct, diffuse and total) on arbitrary surfaces from routine meteorological observations synoptic. A model (ENLOSS) for calculation of transmission and infiltration flosses in buildings and local energy losses from time series and frequency statistics established over 20-30 years. Use of the PHOENICS program system with specially developed satellite programs for three dimensional simulations of air flow and pressure distribution around buildings.

25759 **(BMFT-FB-T—85-142) Heat pump with external combustion. Final report.** Bauer, B.; Mantel, A. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.); Stuttgart Univ. (Germany, F.R.). Inst. fuer Thermodynamik der Luft- und Raumfahrt). Dec 1985. 88p. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE86751456.

Development of a heat pump unit is described in which the heat pump cycle and a Clausius-Rankine vapor power unit are connected by a common condensor and a combined expansion-compression-machine. The propulsive energy is heat. Development of a combined expansion-compression-machine was accomplished according to the free piston principle, with air as the working fluid. Testing of the free piston machine (air) was carried out in an, especially for that purpose, brought up test rig. Design and production of a combined expansion-compression-machine were accomplished according to the free piston principle, with R 12 as the working fluid. Design and mounting of a heat pump test facility to perform the above mentioned heat pump process are described. Mounting of a test rig was done in order to proof the thermal stability of refrigerants. (orig.). With 46 figs., 5 refs.

25760 **(BMFT-FB-T—85-143) Model investigation project to ensure saving by a gas-fired absorption heat pump and system-integrated heat storage, as well as by utilization of geothermal energy. Final report.** Reinmuth, F. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.); Kraftanlagen A.G., Heidelberg (Germany, F.R.)). Dec 1985. 71p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE86751455.

The project is design, engineering, installation and start-up of the respective system, as well as checking the profitability and economic efficiency of a gas-fired absorption heat pump and utilization of geothermal energy. Demonstration project is based on a monovalent heat pump system. Model calculations are presented concerning capacity and energy requirements of the entire system, including capacity optimization of the monovalent heat pump system, with heat storage being also taken into consideration for peak load coverage. Detail engineering is included or heat generation, installation and commissioning, checking all performance data. The absorption heat pump has now already been operated for three winters. Evidence was given that the annual heat pump plant coefficient of performance specified in the contractual warranty was actually met. The profitability of the entire system (including also all peripheral electric consumers) is, however, not quite sufficient at present, see also report. (orig.). With 21 figs., 4 tabs., 4 refs.

25761 **(CONF-860531—1) National planning to stimulate the use of energy-efficient building technologies.** Brown, M.A. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 9p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86002243.

From Annual meeting of the Association of American Geographers; Minneapolis, MN, USA (4 May 1986).

A set of strategies were developed for stimulating the commercial application and use of R & D results from DOE's Office of Buildings and Community Systems. After characterizing barriers to technology transfer in the buildings industry and problems which are innate to transferring energy-conserving technologies, attention turns to five candidate strategies. These strategies seek to: (1) influence key decision-makers to apply BCS research results; (2) engage in laboratory/industry cooperative R & D; (3) focus on innovators and leaders as industrial partners; (4) work through trade and professional associations; and (5) generate end-user demand.

25762 **(CONF-8410397—) Specialists' meeting: Modern gas technologies in housing construction. Proceedings.** (Arbeitsgemeinschaft fuer Sparsamen und Umweltfreundlichen Energieverbrauch e.V. (ASUE), Frankfurt am Main (Germany, F.R.)). 1984. 120p. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE86751626.

From Specialists' meeting on modern gas technologies in housing construction; Frankfurt am Main, F.R. Germany (24 Oct 1984).

The following talks were given at a specialists' meeting with the title "Modern gas technologies in housing construction" held in Frankfurt on October 24th 1984: Indoor air and energy-saving heating systems; Modern gas technologies - gas heat for household purposes; Experience with fuel value appliances in the modernisation of old buildings; Heating systems in housing construction - an important environmental factor in conurbations; Requirements and possibilities for the use of gas heat pumps in the field of housing and the L.A.S. System, a new potential for decentralised heating without indoor air. (BR).

25763 (CONF-8410397—, pp 1-18) **Indoor climate and energy-saving heating systems.** Steimle, F. (Essen Univ., Gesamthochschule, Germany, F.R. Inst. fuer Angewandte Thermodynamik und Klimatechnik). 1984. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE86751626.

From Specialists' meeting on modern gas technologies in housing construction; Frankfurt am Main, F.R. Germany (24 Oct 1984).

A number of different elements, such as temperature, humidity, heat radiation, lighting etc play a part in creating the comfort of an indoor climate. Some of these elements can be influenced in modern housing construction by the architecture of the building

and the selection of building materials, other elements, however, deviate more from the desired effect due to modern building methods than older ones. The author goes into the factors of an indoor climate, air renewal, ventilation methods, the transmission and ventilation heat requirement and heat recovery. (BR).

25764 (CONF-8410397—, pp 2-29) **Modern gas technologies - gas heat for household purposes.** Ludwikowski, P. (Main-Gaswerke A.G., Frankfurt am Main, Germany, F.R.). 1984. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE86751626.

From Specialists' meeting on modern gas technologies in housing construction; Frankfurt am Main, F.R. Germany (24 Oct 1984).

Natural gas consumption increased by 46% between 1973 and 1983. This growth was achieved almost entirely in the household and small user sector. Avertical strokeongside the growth in consumption there was a matching development in appliances. The article deals especially with practically tested and readily available gas burners from the market. The trend is shifting away from central heating towards decentralised heat supplies, especially in blocks of flats. Consideration is given to circulation water heaters, special gas heating boilers, fuel value boilers, fuel value boilers with pulsating burners, gas-powered heat pumps and the gas heating centre. Influence factors that have resulted in a more efficient use of energy and an improvement in appliances are listed. (BR).

25765 (CONF-8410397—, pp 1-14) **Experience with fuel value appliances in the modernisation of old houses.** Weber, W. (Nassauisches Heim Siedlungsbaugesellschaft m.b.H., Frankfurt am Main, Germany, F.R.). 1984. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE86751626.

From Specialists' meeting on modern gas technologies in housing construction; Frankfurt am Main, F.R. Germany (24 Oct 1984).

The Nassauisches Heim (housing association) owns about 42000 dwellings in the Frankfurt area. Over 50% of these have oil or gas-fired central heating. In recent years old heating systems have been replaced by fuel value appliances. By comparison with conventional heating boilers, this has led to energy and cost savings in the region of between 25 and 28%. The boilers installed are made by "Hydrotherm". The cost savings arising from the use of new fuel value boilers is much higher than those resulting from thermal insulation on the building. This was found in insulated and non-insulated apartments in which fuel value were installed. (BR).

25766 (CONF-8410397—, pp 1-21) **Heating systems in housing construction: An important environmental factor in conurbations.** Hoff, H. (Bayerisches Landesamt fuer Umweltschutz, Muenchen, Germany, F.R. Abt. fuer Luftreinhaltung). 1984. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE86751626.

From Specialists' meeting on modern gas technologies in housing construction; Frankfurt am Main, F.R. Germany (24 Oct 1984).

Starting from the final energy consumption structure of households, the introduction studies what amounts of which pollutants are given off as a result of using various energy sources in households for heating living quarters. The emissions from household firing are estimated for Bavaria. The actual emission conditions in the Nuernberg-Fuerth area are represented. From these, demands for clean air are formulated. Among other things, the type of fuel used plays a crucial part in the development of pollutants. Solid fuel should no longer be used at all for private heating in conurbations. Wherever solid and liquid fuels are used in large-scale heating or thermal power stations, these central firing complexes should, without exception, be made to fulfil the requirements of the large-scale firing complex regulations for new complexes. Gas is able to make the largest contribution to the improvement of the air. Expansion of gas supplies and remote central heating should therefore be urged on. This could be achieved both by the use of state subsidies and compulsory regulations in development planning. (BR).

25767 (CONF-8410397—, pp 1-15) **Requirements and possibilities for the use of gas-powered heat pumps in the housing sector.** Pegels, U. (Thyssen-Wohnstaetten A.G., Essen, Germany, F.R.). 1984. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE86751626.

From Specialists' meeting on modern gas technologies in housing construction; Frankfurt am Main, F.R. Germany (24 Oct 1984).

This paper handles the development, preparations, construction and operation of a heat pump system driven by a gas motor for 72 flats in Duisburg. After optimising the building, the planning analysis indicated that the use of a gas motor-powered heat pump with power tower for central water heating would make more efficient use of the natural gas as primary energy possible. The entire energy centre was placed below ground at basement level and connected with the underground car park. Structural measures made it possible to avoid the transmission of sound conducted through solids to the living quarters. (BR).

25768 (CONF-8410397—, pp 1-19) **L.A.S. system - a new possibility of decentralised heating without indoor air.** Jannemann, T. (Ruhrgas A.G., Dorsten, Germany, F.R.). 1984. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE86751626.

From Specialists' meeting on modern gas technologies in housing construction; Frankfurt am Main, F.R. Germany (24 Oct 1984).

The demand for decentralised heating systems is increasing, as they are most likely to do justice to present-day demands on comfort, energy economy and the simplification of billing for heating costs. However, decentralised heating systems can lead to critical situations in dwellings where the window cracks are airtight. One decentral heating device that avoids such situation is the L.A.S system. It comprises the actual air-exhaust chimney and the gas burners linked to it. Various system variants on L.A.S are presented. The system has been conceived primarily with blocks of flats in view. In such cases, up to 10 burners with a maximum output of about 25 kW each can be connected. The great advantage of the L.A.S system lies in the complete freedom it provides for planning the location. The system can also be incorporated into modernisation projects for old buildings and refurbishment. The article provides some hints on the installation of chimneys and burners in the closing sections. (BR).

25769 (CONF-8510218—) **Field data acquisition for building and equipment energy-use monitoring.** (Oak Ridge National Lab., TN (USA)). Mar 1986. Contract AC05-84OR21400. 282p. NTIS, PC A13/MF A01; 1; GPO Dep. File Number DE86008569.

From Field data acquisition for building and equipment energy-use monitoring national workshop; Dallas, TX, USA (16 Oct 1985).

The Field Data Acquisition for Building and Equipment Energy-Use Monitoring Workshop was held October 16-18, 1985, at the Sheraton Dallas Hotel & Towers in Dallas, Texas. The purpose of the workshop was to exchange information and experiences; to review current data acquisition hardware and software; and to formulate a set of major data acquisition and reduction methodology issues, along with alternatives for their resolution. The workshop was oriented towards planners, designers, operators, and users of monitoring equipment in residential, commercial, and institutional buildings. Professionals (106) representing 71 organizations consisting of gas and electric utilities, independent R & D organizations, national laboratories, consulting companies, federal government agencies, universities, manufacturers, and state agencies were in attendance. Each of the 25 papers presented have been separately indexed for inclusion in the Energy Data Base.

25770 (CONF-8604109—3) **Role of auditor salesmanship in residential conservation incentive: a case study.** Brown, M.A.; Berry, L.G.; White, D.L.; Zeidler, P. (Oak Ridge National Lab., TN (USA); Tennessee Univ., Knoxville (USA); Florida Power and Light Co., Miami (USA)). 1986. Contract AC05-84OR21400. 13p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86008504.

From Pacific Gas and Electric (PG&E) energy expo; Oakland, CA, USA (1 Apr 1986).

This paper examines the role of auditor salesmanship in four residential conservation incentive programs offered by Florida Power and Light (FPL). Regression analysis was used to examine variations in levels of program participation attributable to auditor differences, after controlling for variations in the types of households served by each auditor. Auditor characteristics are found to explain as much as 14% of the total variation in the performance measures, when entered after statistically significant household characteristics. In particular, auditor attributes such as years of education, previous sales experience, and extroversion are found to influence sales effectiveness.

25771 **(DOE/BP—584) Preliminary air-to-air heat exchangers testing results for the Residential Standards Demonstration Program. Program results report No. 2.** Reiland, P.; McKinstry, M.; Thor, P. (USDOE Bonneville Power Administration, Portland, OR. Office of Conservation). Aug 1985. 35p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86008827.

This paper reports measurements for airflow delivered by air-to-air heat exchangers (AAHX) installed in 227 single family homes in the Pacific Northwest. The homes are part of Bonneville Power Administration's Residential Standards Demonstration Program, and represent approximately one-half of the entire sample of homes equipped with AAHX's which were to be tested. They were constructed to meet the Model Conservation Standards proposed by the Northwest Power Planning Council, and generally have lower natural infiltration rates than typical new homes. The airflow measurements reported here were made with the AAHX units operating on high speed. Installed cost for the AAHX's is also reported. Data for the remainder of the homes not yet measured will be reported in 1986.

25772 **(DOE/BP/13301—2) Residential air infiltration leakage repair project. Final report.** (Lambert Engineering, Inc., Bend, OR (USA)). Mar 1986. Contract AI79-83BP13301. 97p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE86008822.

Forty existing homes, representing the northwest's housing stock, were repaired to reduce air infiltration, and tested. A test-repair-test sequence was used to measure effects of individual repairs. Leaks were located and repaired without instruments, then a blower door and smoke testing was used to find flaws in repairs, and leaks missed earlier. Costs and benefits of both the "blind" and blower-door-aided leak repairs wre measured by collecting repair material and labor cost data, and measuring leakage changes with blower doors.

25773 **(DOE/BP/13795—8) Literature review on energy conservation investment in nonresidential buildings.** Nieves, L.A.; Fang, J.M. (Pacific Northwest Labs., Richland, WA (USA)). Jan 1986. Contract AC06-76RL01830;AC79-83BP13795. 99p. NTIS, PC A05/MF A01; GPO Dep. File Number DE86008370.

This document is the product of a study conducted by Battelle, Pacific Northwest Laboratory (PNL) to support the overall design effort for a region-wide nonresidential building survey. The study involved review of literature and data sources related to conservation investment decision-making in the commercial sector. It paralleled another study reviewing literature and data sources on the physical aspects of the building and equipment stock in nonresidential buildings.

25774 **(DOE/BP/17006—1) So show me: new energy efficient commercial buildings.** (Church/Davis Architects, Portland, OR (USA)). Aug 1985. Contract RO79-84BP17006. 30p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86008820.

This booklet introduces a dozen energy efficient projects where the idea of "energy conservation equals money" was taken seriously. A brief technical description of each project is included.

25775 **(DOE/BPA—6008854) Report on the Bonneville Power Administration's radon monitoring in the residential weatherization program.** (USDOE Bonneville Power Administration, Portland, OR). Jan 1986. 15p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86008854.

In October 1984, the Bonneville Power Administration (BPA) began offering free radon monitoring to participants of its regionwide Residential Weatherization Program. The purpose of the radon monitoring is to provide information to participating homeowners or consumers on the average radon concentrations within their residences. This radon concentration information and other information on indoor air quality (IAQ) is provided to assist homeowners on their decision to install "house-tightening" weatherization measures. This radon report will present background information on why BPA decided to offer radon monitoring, the procedures used for monitoring, the extent of BPA radon monitoring in the region, and results of this monitoring. Subsequent BPA radon monitoring reports will be produced on a quarterly basis which will include a brief narrative on the radon monitoring and provide a summary of the radon data received to date.

25776 **(DOE/CE—0145) Innovative financing: a survey of projects supported by the US Department of Energy.** (USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC). Feb 1936. 29p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86008484.

This report describes projects that feature innovative approaches to the financing of energy efficiency improvements. Encouraging energy efficiency has been a major concern of DOE since the Department's inception. Especially in the past two years, DOE has taken a number of steps to encourage, familiarize people with, and demonstrate realistic approaches to using a variety of innovative financing techniques to fund energy efficiency improvements. These DOE initiatives include: (1) funding demonstrations in a number of building sectors; (2) sponsoring analyses and studies of opportunities for the use of innovative financing; (3) providing grants to states that support a range of services relating to financing; and (4) working to eliminate legal and regulatory roadblocks to using innovative financing for improvements to government buildings.

25777 **(DOE/CE/30746—5) Variable transmittance electrochromic windows for passive solar application. Final report, July 23, 1982-October 31, 1985.** (EIC Labs., Inc., Norwood, MA (USA)). Mar 1986. Contract AC03-82CE30746. 98p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE86008330.

This report summarizes a three year program at EIC Laboratories on the development of variable transmittance electrochromic windows for passive solar applications. The program is the first phase of a proposed two phase program that has as its overall objective the development and scale-up of solid-state electrochromic windows culminating in the transfer of this technology to the fenestration industry. The objective of the Phase I program was to establish the feasibility of electrochromic windows through the identification and characterization of component materials.

25778 **(DOE/SF/11657—T1) Open-cycle chemical heat pump and energy storage system. Final report of Research Program, June 1982-September 1983.** Robison, H.I. (Coastal Carolina Coll., Conway, SC (USA). Carolina Energy Lab.). Oct 1983. Contract AC03-82SF11657. 85p. Coastal Carolina College/Univ. of S. Carolina Energy Lab., Conway, S.C. 29526. File Number TI86008550.

A liquid desiccant heat pump that can heat, cool, humidify, and dehumidify, as well as heat domestic water, has been designed, developed, and tested over a six-year period. Successful operation of the machine demonstrated that a heating cycle utilizing the heat of sorption of a desiccant solution could be added to a desiccant cooling system, thus creating an open-cycle liquid desiccant heat pump. The liquid system was shown to possess a unique capability: the ability to store energy, not as sensible heat but as chemical potential energy, in an uninsulated storage tank with a volume that is an order of magnitude smaller than the insulated volumes needed for water or rock bed storage systems. The spent absorbent solution

was reconcentrated in a roof-top solar-collector/reconcentrator. Additionally, it was shown that a packed-column could also act as the reconcentrator; for this operation, the desiccant solution was heated by flat-plate solar collectors, by off-peak electricity, and by waste heat from a vapor compressor.

25778 **(LA—10649-MS) DOE-2 verification project. Phase I. Final report.** Diamond, S.C.; Cappiello, C.C.; Hunn, B.D. (Los Alamos National Lab., NM (USA)). Feb 1986. Contract W-7405-ENG-36. 72p. NTIS, PC A04/MF A01. File Number DE86008566.

This report gives the final results of the Phase I tasks of the DOE-2 Verification Project. DOE-2 is a computer program that was developed to provide architects and engineers with a public domain tool for performing energy analyses of buildings. Phase I of the project is an analytical and empirical verification of DOE-2 as a computational unit rather than as subprograms or separate algorithms.

25780 **(LBL—20505) Energy conservation in large buildings.** Rosenfeld, A.H.; Hafemeister, D. (Lawrence Berkeley Lab., CA (USA)). Aug 1985. Contract AC03-76SF00098. 25p. (EEB—85-7; CONF-8504174—3). NTIS, PC A02/MF A01; GPO Dep. File Number DE86007488.

From Energy sources: conservation and renewables; Washington, DC, USA (27 Apr 1985).

As energy prices rise, newly energy aware designers use better tools and technology to create energy efficient buildings. Thus the US office stock (average age 20 years) uses 250 kBTU/ft^2 of resource energy, but the guzzler of 1972 uses 500 (up x 2), and the 1986 ASHRAE standards call for 100 to 125 (less than 25% of their 1972 ancestors). Surprisingly, the first real cost of these efficient buildings has not risen since 1972. Scaling laws are used to calculate heat gains and losses of buildings to obtain the ΔT(free) which can be as large as 15 to 30°C (30 to 60°F) for large buildings. The net thermal demand and thermal time constants are determined for the Swedish Thermodeck buildings which need essentially no heat in the winter and no chillers in summer. The BECA and other data bases for large buildings are discussed. Off-peak cooling for large buildings is analyzed in terms of saving peak-electrical power. By downsizing chillers and using cheaper, off-peak power, cost-effective thermal storage in new commercial buildings can reduce US peak power demands by 10 to 20 GW in 15 years. A further potential of about 40 GW is available from adopting partial thermal storage and more efficient air conditioners in existing buildings.

25781 **(NP—6751460) Gas heat pump survey - practical examples. As of January 1985.** (GWP Gaswaermepumpen Gesellschaft m.b.H., Dorsten (Germany, F.R.)). 1985. 50p. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number DE86751460.

The publication as of stage of January 1985 comprehensively discusses existing gas heat pump systems applied in outdoor swimming pools, schools, trains, public buildings, stores and residential buildings. The tabulation takes account of the following aspects and factors: object, location, institution or organ in charge of the plant, supplier, year of initiation, heat source, heating/cooling performance, number of units, flow temperature/flowback temperature. (DG).

25782 **(NP—6751621) Heat losses of six differently dimensioned solar water heaters.** Schlaepfer, B.; Wellinger, K. (Bundesamt fuer Energiewirtschaft, Bern (Switzerland)). Sep 1984. 23p. (In German). NTIS (US Sales Only), PC A02/MF A01. File Number DE86751621.

High heat losses of solar water heaters have a negative influence on the net energy efficiency of solar heating systems. The study abstracted has been analyzing the heat losses of 6 differently sized solar and electric water heaters with identical thermal insulation. The mean insulation K-value was determined by way of independent series of tests. Heat losses turned out to depend to a decisine degree on the number of connecting lines and flanges. Careful and complete insulation of the respective thermal bridges is considered the only effective measure. (BWI).

25783 **(NP—6751623) Controlled ventilation in dwellings.** (Hauptberatungsstelle fuer Elektrizitaetsanwendung e.V., Frankfurt am Main (Germany, F.R.)). Oct 1984. 16p. (In German). NTIS (US Sales Only), PC A02/MF A01. File Number DE86751623.

As thermal insulation improves, the problem of air quality increases. For this reason, technical measures for renewing indoor air become necessary in order to comply with the present-day energy situation, and even more so for the future. The HEA working group 'Indoor Air Technology' comments on questions of ventilation in dwellings, irrespective of the heating system or the type of energy used. Suggestions for the type of ventilation for the dwelling which are most correct from the energy and building physics points of view are presented, which fulfil all the present-day standards with regard to comfort and well-being. Above all, the precisely determined and controlled renewal of air throughout the dwelling is treated. (BR).

25784 **(NP—6751625) Heat pump/solar collector systems.** Suter, J.M. (Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen (Switzerland)). May 1982. 28p. (In French). NTIS (US Sales Only), PC A03/MF A01. File Number DE86751625.

The study abstracted intends to investigate and examine the economics of heat pump/solar collector systems. Measurements and comparative evaluations of different low temperature collectors are followed by a real condition examination of the heating system installed in a Tessin building. The building consists of solar collectors, a heat pump and underground storage unit. The study points out daily and annual energy balances. Heat pumps proved to save about 50% of the required auxiliary energy. Collector efficiency turned out to be 40%; 65% of the energy consumption are covered by solar power. (BWI).

25785 **(ORNL/CON—173) Heat pump water heater laboratory test and design model validation.** Zimmerman, K.H. (Oak Ridge National Lab., TN (USA)). Mar 1986. Contract AC05-84OR21400. 85p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE86008938.

A residential separated-type heat pump water heater (HPWH) unit was tested in a laboratory under controlled environmental conditions. Steady-state tests were conducted over a range of ambient temperatures, relative humidities, and inlet water temperatures. For the ambient temperature rise from 10 to 38°C (50 to 100°F), the evaporator capacity increased 62%, the condenser capacity increased 67%, and the coefficient of performance (COP) improved 34% (from 1.89 to 2.54). As the HPWH condenser inlet water temperature increased from 46 to 54°C (115 to 130°F) while the ambient temperature remained 23°C (73°F), the condenser capacity decreased 4% and the COP declined 14% (from 2.21 to 1.89). Test data were used to form a data base on HPWH performance which was subsequently used to validate the HPWH design model. The HPWH design model, a computer program derived from the existing ORNL Heat Pump Design Model, was proven to be capable of predicting the performance of the separated-type HPWH system and is intended to be used in studies concerning the improvement of HPWH performance.

25786 **(ORNL/CON—177/V1) ORNL Residential Reference House Energy Demand model (ORNL-RRHED). Volume 1. Overview and report summary.** Hamblin, D.M.; Thomas, B. Jr.; Maddigan, R.J.; Forman, C.W. Jr.; Bibo, L.J.; McKeehan, K.M. (Oak Ridge National Lab., TN (USA)). Feb 1986. Contract AC05-84OR21400. 44p. NTIS, PC A03/MF A01; GPO Dep. File Number DE86007082.

This report describes the use and structure of the ORNL Residential Reference House Energy Demand Model (RRHED). RRHED is a computer-based engineering-economic end-use simulation model which forecasts energy demand based on a detailed evaluation of how households use energy for particular appliances. The report is organized into four volumes. The first volume provides an overview of the modeling approach and gives a short summary of the material presented in the other three volumes. The second volume is a user reference guide which provides the details necessary for users of the model to run the code and make changes

to fit their particular application. Volume 3 presents the basic theoretical rationale for the RRHED model structure. The last volume reports on the application of the model to the analysis of two different kinds of issues: one is the examination of conservation policy impacts and the other is the forecasting of electricity demand in a need for power assessment. The report has two major objectives. The first is to provide a reader with little background in end-use modeling with an introduction to how the RRHED model works. The second is to provide the details needed by a user of the model to understand not only the theory behind the model specification, but also the structure of the code. This information will allow for the modification of subroutines to fit particular applications.

25787 **(ORNL/CON—177/V2) ORNL Residence Reference House Energy Demand Model (ORNL-RRHED). Volume 2. User reference guide.** Hamblin, D.M.; Thomas, B. Jr.; Maddigan, R.J.; Forman, C.W. Jr.; McKeehan, K.M. (Oak Ridge National Lab., TN (USA)). Feb 1986. Contract AC05-84OR21400. 273p. NTIS, PC A12/MF A01; 1; GPO Dep. File Number DE86007042.

This report describes the use and structure of the ORNL Residential Reference House Energy Demand Model (RRHED). RRHED is a computer-based engineering-economic end-use simulation model which forecasts energy demand based on a detailed evaluation of how households use energy for particular appliances. The report is organized into four volumes. The first volume provides an overview of the modeling approach and gives a short summary of the material presented in the other three volumes. The second volume is a user reference guide which provides the details necessary for users of the model to run the code and make changes to fit their particular application. Volume 3 presents the basic theoretical rationale for the RRHED model structure. The last volume reports on the application of the model to the analysis of two different kinds of issues: one is the examination of conservation policy impacts and the other is the forecasting of electricity demand in a need for power assessment. The report has two major objectives. The first is to provide a reader with little background in end-use modeling with an introduction of how the RRHED model works. The second is to provide the details needed by a user of the model to understand not only the theory behind the model specification, but also the structure of the code. This information will allow for the modification of subroutines to fit particular applications.

25788 **(ORNL/CON—177/V3) ORNL Residential Reference House Energy Demand model (ORNL-RRHED). Volume 3. Technical description.** Hamblin, D.M.; Thomas, B. Jr.; Maddigan, R.J.; Forman, C.W. Jr.; Bibo, L.J.; McKeehan, K.M. (Oak Ridge National Lab., TN (USA)). Feb 1986. Contract AC05-84OR21400. 247p. NTIS, PC A11/MF A01; GPO Dep. File Number DE86007043.

This report describes the use and structure of the ORNL Residential Reference House Energy Demand Model (RRHED). RRHED is a computer-based engineering-economic end-use simulation model which forecasts energy demand based on a detailed evaluation of how households use energy for particular appliances. The report is organized into four volumes. The first volume provides an overview of the modeling approach and gives a short summary of the material presented in the other three volumes. The second volume is a user reference guide which provides the details necessary for users of the model to run the code and make changes to fit their particular application. Volume 3 presents the basic theoretical rationale for the RRHED model structure. The last volume reports on the application of the model to the analysis of two different kinds of issues: one is the examination of conservation policy impacts and the other is the forecasting of electricity demand in a need for power assessment. The report has two major objectives. The first is to provide a reader with little background in end-use modeling with an introduction to how the RRHED model works. The second is to provide the details needed by a user of the model to understand not only the theory behind the model specification, but also the structure of the code. This information will allow for the modification of subroutines to fit particular applications.

25789 **(ORNL/CON—177/V4) ORNL Residential Reference House Energy Demand model (ORNL-RRHED). Volume 4. Case studies.** Hamblin, D.M.; Thomas, B. Jr.; Maddigan, R.J.; Forman, C.W. Jr.; Bibo, L.J.; McKeehan, K.M. (Oak Ridge National Lab., TN (USA)). Feb 1986. Contract AC05-84OR21400. 92p. NTIS, PC A05/MF A01; GPO Dep. File Number DE86007044.

This report describes the use and structure of the ORNL Residential Reference House Energy Demand Model (RRHED). RRHED is a computer-based engineering-economic end-use simulation model which forecasts energy demand based on a detailed evaluation of how households use energy for particular appliances. The report is organized into four volumes. The first volume provides an overview of the modeling approach and gives a short summary of the material presented in the other three volumes. The second volume is a user reference guide which provides the details necessary for users of the model to run the code and make changes to fit their particular application. Volume 3 presents the basic theoretical rationale for the RRHED model structure. The last volume reports on the application of the model to the analysis of two different kinds of issues: one is the examination of conservation policy impacts and the other is the forecasting of electricity demand in a need for power assessment. The report has two major objectives. The first is to provide a reader with little background in end-use modeling with an introduction to how the RRHED model works. The second is to provide the details needed by a user of the model to understand not only the theory behind the model specification, but also the structure of the code. This information will allow for the modification of subroutines to fit particular applications.

25790 **(ORNL/CON—191) Cost-effectiveness of single and multiple CACS retrofit actions in multifamily apartment buildings.** Nicol, J.L.; Stovall, T.K. (Oak Ridge National Lab., TN (USA)). Mar 1986. Contract AC05-84OR21400. 57p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE86008941.

This report assesses the cost-effectiveness of energy conservation measures in apartment buildings in varying climatic regions. Five measures - roof insulation, wall insulation, storm windows, caulking and weatherstripping, and night setback/setup of thermostats - were considered in great detail; other measures, such as heating and cooling equipment modifications, were considered in a more limited fashion. In general, payback periods for measures tended to increase with decreasing heating degree days and were usually lower for a high-rise building than for a low-rise building. When electric demand charges were considered, the payback periods were slightly shorter. Energy savings for storm windows and caulking and weatherstripping were strongly affected by the assumed infiltration reduction. Caulking and weatherstripping appeared to be cost-effective in most of the climates considered. Wall insulation was only cost-effective when added incrementally to prerequired exterior wall changes. The interaction among multiple measures installed together did not greatly alter the cost-effectiveness of the measures.

25791 **(PB—86-135274/XAB) Evaluation of the thermal integrity of the building envelopes of eight federal office buildings.** Grot, R.A.; Persily, A.K.; Chang, Y.M.; Fang, J.B.; Weber, S. (National Bureau of Standards, Washington, DC (USA). Center for Building Technology). Sep 1985. 199p. (NBSIR—85/3147). NTIS, PC A09/MF A01.

Diagnostic test methods were applied to eight federal office buildings in order to assess the applicability of these measurement methods for determining the thermal integrity of the building envelope. The eight federal office buildings were located in Anchorage, AK; Ann Arbor, MI; Columbia, SC; Fayetteville, AR; Huron, SD; Norfolk, VA; Pittsfield, MA and Springfield, MA.

25792 **(PB—86-142098/XAB) Impact of energy pricing and discount-rate policies on energy conservation in federal buidings. Final report.** Fuller, S.K.; Ruegg, R.T. (National Bureau of Standards, Washington, DC (USA). Center for Applied Mathematics). Nov 1985. 61p. (NBSIR—85/3262). NTIS, PC A04/MF A01.

The study investigates how energy-conservation projects for federal buildings would be affected by a change in energy pricing and discount-rate policies. It focuses on the choice between marginal-cost prices versus average market prices and a 10% discount rate versus a 7% discount rate. Graphical and numerical comparisons of hypothetical cases in selected geographical areas illustrate the expected impact on selection, design and sizing, and priority of energy-saving projects.

25793 **(PB—86-142148/XAB) Energy prices and discount factors for life-cycle cost analysis: annual supplement to NBS (National Bureau of Standards) handbook 135 and NBS Special Publication 709, 1985 edition.** Lippiatt, B.C.; Weber, S.F.; Ruegg, R.T. (National Bureau of Standards, Washington, DC (USA)). Nov 1985. 97p. (NBSIR—85/3273). NTIS, PC A05/MF A01.

The report provides the 1985 annual edition of the energy-price and discount-factor tables used to supplement both the federal life-cycle costing methodology as described in NBS Handbook 135 (HB 135) and private sector life-cycle cost analysis as described as described in NBS Special Publication 709 (SP 709). Tables A (7%), Ba, and C represent revisions of Appendices A, B, and C, respectively, of HB 135. They should be used in life-cycle cost analyses of federal energy-conservation projects. Tables A (10%), Bb, and C are to be used in life-cycle cost analyses of federal non-energy conservation projects that require energy-price forecasts. The last section of the report, the supplement for private sector life-cycle cost analysis, is identical to Appendix B, Part I of SP 709 and is provided for the convenience of private sector analysts wishing to make use of federal energy-price forecasts.

25794 **(PB—86-153848/XAB) Opportunities for full-scale testing of residential building interactions in environmental chambers.** Persily, A.K. (National Bureau of Standards, Washington, DC (USA). Center for Building Technology). Dec 1985. 21p. (NBSIR—85/3194). NTIS, PC A02/MF A01.

The report focuses on opportunities for full-scale testing of residential building interactions in environmental chambers, where one has control of weather conditions and occupant effects. Such research will increase our understanding of the physical nature of these interactions and their effects on energy use, comfort, cost, and other factors. In the report the authors review past and current research in the area of full-scale testing in environmental chambers and other related work. Based on the review, further research is proposed in several important areas of residential building performance.

25795 **(PB—86-163821/XAB) Building emulation computer program for testing of energy management and control system algorithms.** May, W.B.; Park, C. (National Bureau of Standards, Washington, DC (USA). Building Equipment Div.). Dec 1985. 133p. (NBSIR—85/3291). NTIS, PC A07/MF A01.

A building emulator can be used to test energy management and control systems (EMCS). The emulator uses a computer program to simulate the responses of a building including the equipment, building space, and building envelope to EMCS commands. Building model software for the emulator has been developed at the National Bureau of Standards (NBS) in an effort to assist the United States Naval Civil Engineering Laboratory (NCEL), which is developing a sophisticated building emulator. The concept of the building emulator and the building emulator computer program are described in this report. The program includes the weather, the air handling unit, the zone, and the comfort model. In addition, the energy compilation routine is also included. The models presented here are simplified models. With these abridged models, a single zone building with exterior walls and a single deck air handling unit are simulated. A complete FORTRAN source code of the building emulator computer program is appended.

25796 **(SBI-R—171) Summer condensation - a risk due to interior postinsulating of outer walls.** Andersen, N.E. (Statens Byggeforskningsinstitut, Hoersholm (Denmark)). 1985. 30p. (In Danish). Statens Byggeforskningsinstitut, P.O. Box 119, DK-2970, Hoersholm, Denmark. Price: Dkr. 59,50. EFP-82.

Investigations carried out by SBI have shown that when the sun heats up a wet, half-brick wall, condensation sometimes occurs on the vapour barrier in the mineral wool insulation, together with serious damping of the wooden laths in the insulation. However, calculations of the temperature conditions in a 1 1/1-brick wall show that there is little risk of such summer condensation with wall thicknesses exceeding half-brick. Thus, it is only with half-brick walls that there is a risk of condensation, and then only where such walls are exposed both to driving rain and sun. Such walls are relatively rare (for example, unprotected gable walls). The best way to avoid summer condensation is to use an exterior water-repelling cladding that keeps rain off the brickwork. The risk of summer condensation can also be reduced by leaving a ventilated space between wall and insulation. Alternatively, an asphalt felt can be placed on the inside of the wall before the insulation is mounted.

25797 **(SP-RAPP—1985-05) Laboratory testing of heat pumps. Experiences 1977-1983.** Fahlen, P. (Statens Provningsanstalt, Boraes (Sweden)). 1985. 26p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. File Number DE86751523.

The reported testing includes capacity, heat effect, electric power consumption pressure drop across the heat exchanger, control of safety, electrical installations, and noise. 115 heat pumps have been tested which makes some general comparisons possible. Coefficient of performance is reported statistically on diagrams. The makes are kept anonymous.

25798 **(SPV—71) Heat supply and planning of buildings.** (Statens Planverk, Stockholm (Sweden)). 1985. 67p. (In Swedish). NTIS (US Sales Only), PC A04/MF A01. File Number DE86751522.

The report gives a survey of the development of densely built areas and the different conditions for heat supply and different types of buildings. The heating systems are described and compared as to environmental effects, space requirements, safety, and economy. Municipal planning of energy management is dealt with and the influence on physical planning and on final plans are exemplified.

25799 **(STU—84-4041) Thermoeconomic optimization of a heat pump system.** Wall, G. (National Swedish Board for Technical Development, Stockholm). 14 Sep 1984. 40p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86751524.

This paper presents the application of thermoeconomics to the optimization of a single stage heat pump cycle. The method described is well-suited for application to thermodynamic processes and as a partial result the exergy losses can be determined. The marginal cost for an arbitrary variable can also be calculated. The efficiencies of the compressor, the condenser, the evaporator and the electric engine are chosen as decision variables, which are to be optimized. Other parameters such as the price of electricity, the temperature of the delivered heat and the operation time are considered to be constants. These parameters may vary between each optimization and the results are presented for different values of them.

25800 **(VTT-TUTK—374) Energy saving in heating of concrete.** Kilpi, E.; Kukko, H. (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)). Oct 1985. 86p. (In Finnish). NTIS (US Sales Only), PC A05/MF A01. File Number DE86751571.

Approximately 2.0-2.5 Mm^3 of concrete is used yearly in situ in Finland, almost one half of which is used during the cold season. The energy consumption prior to demoulding is 100-150 kWh per m^3 of concrete on average, although major variations exist which in turn cause wide variations in energy costs. Because of the rapid turn-over in in-situ concreting, measures taken towards saving of energy should not prolong the hardening time. For this reason, efficient heating is necessary at the early phase of hardening. The assurance of safety at work anticipates, in addition to an effective over-all heating method, particular care with respect to temperatures at the edges of the structures. The most economical method

seems to involve the use of heating until 40-45% of the final strength is reached, together with the addition of one strength class , which is always required in a one to two-day turn-over in order to ensure the required 60% of the design strength at demoulding. The energy consumption during hardening is relatively low in comparison with leveling and drying costs. The minimization of heating energy during hardening is therefore not usually beneficial if total costs are considered. For proper heating and the rational use of energy, careful and efficient heat insulation is necessary. Improvement in the heat insulation of moulds is one of the most important tasks in the development of improvements in the use of energy for in-situ concreting.

3202 Transportation

25801 (NP—6751513) Energy conservations for ships. Review. Nielsen, K. (Skibsteknisk Laboratorium, Lyngby (Denmark)). Feb 1983. 52p. (In Danish). NTIS (US Sales Only), PC A04/MF A01. File Number DE86751513.

A survey is made of feasible energy conservation measures on ships. The survey is made by analysing the existing published literature on the subject.

3203 Industry And Agriculture

REFER ALSO TO CITATION(S) 25265, 25299, 25312, 25452, 26239, 26240, 26241

25802 (CONF-860394—1) Utilization of waste energetic material as supplementary boiler fuel. Mahannah, J.L.; Fox, E.C.; Lackey, M.E. (Army Toxic and Hazardous Materials Agency, Aberdeen Proving Ground, MD (USA); Oak Ridge National Lab., TN (USA)). Mar 1986. Contract AC05-84OR21400. 16p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86008224.

From Air pollution control association international speciality conference on technical issues and problems of hazardous waste permitting; Orlando, FL, USA (2 Mar 1986).

The Technology Division of USATHAMA is investigating alternative methods of utilizing combustible energetic waste materials as a fuel supplement. The primary sources of the energetic materials are the demilitarization of conventional munitions and wastes generated during the manufacturing of explosives (principally scraps or explosives out of specification). The bulk of this waste material is trinitrotoluene (TNT) and Composition B (Comp B). Comp B is a mixture of approximately 40% TNT and 60% Cyclotrimethylenetrinitramine (RDX) by weight. There is on the order of 200,000 tons of conventional munitions that have become obsolete, unserviceable or declared surplus. A survey of that inventory indicates that at least fourteen million pounds of energetics (Composition B and TNT) exist in bulk or large caliber ammunition. In addition, waste munitions from the manufacturing process comprise about 2.5 million lb/y of energetic material during peacetime and over 10 million lb/y during mobilization.

25803 (CONF-860540—3) Development of a membrane alkaline fuel cell reactor for energy conservation in the chlor-alkali industry. Taylor, E.J.; Gelb, A.; Campbell, J.P. (Physical Sciences, Inc., Andover, MA (USA)). 1986. Contract FC07-84ID12495. 2p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86004636.

From 169. meeting of the Electrochemical Society; Boston, MA, USA (4 May 1986).

Electrochemical industries consume approximately 7% of all the electric power produced in the United States, and the production of chlorine and caustic soda by the chlor-alkali industry accounts for roughly 20% of this energy consumption. The most advanced chlor-alkali technology utilizes a cation exchange membrane electrolysis cell to produce chlorine, byproduct hydrogen, and 30 wt% NaOH. Prior to commercial sale, the caustic soda is concentrated to 50 wt% by evaporation. The byproduct hydrogen is currently used for its thermal value in the caustic concentration process or is sold commercially.

25804 (DOE/CE/40685—T1) New concepts in wet pressing. Final report. Sprague, C.H. (Institute of Paper Chemistry, Appleton, WI (USA)). Mar 1986. Contract AC02-84CE40685. 88p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE86008553.

This is the final report in a small, year-long project to investigate two subjects: the technical feasibility of displacement pressing and the factors causing the differences in water removal between a laboratory compression tester and a pilot press. (DLC)

25805 (DOE/CS/40279—T1) Industrial slow-speed diesel cogeneration application in the chemical industry. Final report, October 1, 1979-November 30, 1984. Nydick, S.E. (Thermo Electron Corp., Waltham, MA (USA). Energy Systems Div.). 31 Jan 1985. Contract FC01-79CS40279. 218p. NTIS, PC A10/MF A01; 1; GPO Dep. File Number DE86005627.

This report describes the design, performance and economic characteristics of a residual fuel-fired cogeneration system installed at the Hoffmann-La Roche, Inc., Belvidere, New Jersey plant. This system was installed as part of the United States Department of Energy Cogeneration Demonstration Program. The economic and performance characteristics of the system were monitored during the demonstration period of this program. The basic system is described as follows: residual fuel-fired, slow-speed, two-stroke diesel engine rated at 23,300 kW; supplementary fired heat recovery boiler on the diesel engine exhaust to provide 160,000 lb/h, 225 psig process steam to the plant; and cooling water heat exchangers to supply process hot water using the waste heat from the cylinders, pistons and turbocharger. The diesel cogeneration eliminated the need for purchased electricity at the Hoffmann-La Roche plant. The slow-speed, two-stroke diesel and supplementary fired boiler burns residual fuel oil, the liquid fuel most commonly used by US industry and utilities. The cogeneration system has been in continuous operation since December 1982, and has logged over 10,000 hours with an availability of 90% during the demonstration period which has been steadily increasing with time (availability for last 6 months of demonstration period was 93.0%). The system has proven to be economic for the owner/operator, Hoffmann-La Roche, providing an after-tax return of 16.6% during the demonstration period.

25806 (DOE/CS/40361—T31-Vol.1) Blast furnace dynamic model: reconstruction of the PLAIC blast furnace dynamic model. Volume I. Chapters 1-6 and appendices I-V. Report No. 149. Blattner, J.L.; Mika, L.M.; Tanski, J.A.; Schiller, T.L. (Purdue Univ., Lafayette, IN (USA). Purdue Lab. for Applied Industrial Control). Jan 1986. Contract AS07-80CS40361. 516p. NTIS, PC A22/MF A01; 1; GPO Dep. File Number DE86008994.

A new system for the dynamic simulation of the blast furnace has been constructed. The major advantages of the new simulation over the previous one are: The FORTRAN programs are extensively documented; improved execution speed; an interface system for the required operating data has been developed; and top pressure rather than blast pressure is a control variable. The improved execution speed has involved a speedup of approximately seven to one. The new simulation has been constructed to allow reasonable ease in changes or additions to reaction rates and other phenomenon, such as silicon transfer to the hot metal via silicon gas species. It should be possible to apply the simulation to a laboratory furnace. This volume covers the six chapters (conceptualization, reactions considered in simulation model, solution of state equations of working volume and hearth, system structure of the blast furnace simulations, sensitivity analysis of simulation) and the first 5 appendices (transport equations for smetter simulation, pressure drop equation, hearth simulation, computer code listings for material properties and charging). (DLC)

25807 **(DOE/CS/40361—T31-Vol.2) Blast furnace dynamic model: reconstruction of the PLAIC blast furnace dynamic model. Volume II. Appendices VI-XIV. Report No. 149.** Blattner, J.L.; Mika, L.M.; Tanski, J.A.; Schiller, T.L. (Purdue Univ., Lafayette, IN (USA). Purdue Lab. for Applied Industrial Control). Jan 1986. Contract AS07-80CS40361. 426p. NTIS, PC A19/MF A01; 1; GPO Dep. File Number DE86008995.

This volume includes computer code listings for the data development subsystems (for blast and top pressure, furnace geometry and cooling, casting, common data base and fundamental functions), exiting both simulations, opening, closing and reading data files, and writing data files. (DLC)

25808 **(DOE/CS/40361—T31-Vol.3) Blast furnace dynamic model: reconstruction of the PLAIC blast furnace dynamic model. Volume III. Appendices XV and XVI. Report No. 149.** Blattner, J.L.; Mika, L.M.; Tanski, J.A.; Schiller, T.L. (Purdue Univ., Lafayette, IN (USA). Purdue Lab. for Applied Industrial Control). Jan 1986. Contract AS07-80CS40361. 320p. NTIS, PC A14/MF A01; 1; GPO Dep. File Number DE86008996.

Two computer listings are included in this volume. They are for files unique to the smelter simulation, and to the hearth simulation. (DLC)

25809 **(EIR—557) Storage of electrical energy in secondary chemical energy carriers, illustrated by the example of aluminium.** Durisch, W.; Haas, O.; Muelli, R.; Tsukada, A.; Zumbrunnen, H.R. (Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen (Switzerland)). Sep 1985. 60p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE86751630.

The thermochemical oxidation of aluminium with air was successfully demonstrated in a relatively small burner. Although direct caloric measurements of the furnace efficiency could not be made, analyses of the combustion products showed that the powdered-aluminium burner has a satisfactory chemical efficiency. When air is used as oxidant, NOsub(x) production is a problem which could not be solved in the first project phase. Measurements showed that the exhaust gas contains almost exclusively NOsub(x), that NO equilibrium is not reached, and that part of the NO reacts into N_2 and O_2 during cooling of the exhaust gas. Under the aspect of exergy use, it is inefficient to utilize the high-temperature released during thermochemical oxidation only for water heating (district heating plants). It would be put to better use in high-temperature processes, thermal power plants, or cogeneration plants. (orig.).

25810 **(EPRI-CS—4384-Vol.2) Recovery of metal oxides from fly ash including ash beneficiation products. Volume 2. Resource analyses and evaluations. Final report.** Watson, J.S.; Jones, G.; Wilder, R.F. (Oak Ridge National Lab., TN (USA); Kaiser Engineers (California) Corp., Oakland, CA (USA)). Feb 1986. 132p. Research Reports Center, Box 50490 Palo Alto, CA 94303. File Number TI86007950.

This report tabulates, evaluates and summarizes the results of analyzing and evaluating 21 alternate coal ash resources as regards their potential application in the Ash Beneficiation/Direct Acid Leach (DAL) process. It is the objective of the DAL process, combined with ash beneficiation processes, to be able to convert certain select raw coal fly ash resources into various relatively high quality products as profitable commercial operations and to avoid fly ash disposal costs. All of the economic evaluations were made assuming the same economic considerations (i.e. one million tons per year ash processing rate, the same utility and labor costs and the same estimated product net revenues). The calculated economic differences between the ash resources tested were therfore due to the chemical analysis and acid extractabilities differences which resulted in an array of product production ranges, operating and capital costs and calculated return on equity. The investigations made in this study indicate most of the ash resources tested have a composition and extractability which could be profitable if commercially processed in facilities consuming at least several hundred thousand tons per year of fly ash.

25811 **(EPRI-CS—4384-Vol.3) Recovery of metal oxides from fly ash including ash beneficiation products. Volume 3. Conceptual pilot plant description report. Final report.** Wilder, R.F.; Zivanovic, Z. (Kaiser Engineers (California) Corp., Oakland, CA (USA)). Feb 1986. 172p. Research Reports Center, Box 50490 Palo Alto, CA 94303. File Number TI86920198.

A cost and description program was carried out for a conceptual Direct Acid Leach process pilot plant and including conceptual Ash Beneficiation test facilities, for testing and evaluating fly ash resources and to confirm the ultimate design of commercial process facilities. The proposed pilot plant facilities would also allow testing and evaluation of the various beneficiated ash and direct acid leach process products in potential commercial markets. The capital cost requirements for the combined integrated Ash Beneficiation/Direct Acid Leach process pilot plant facilities as described herein were estimated to be 8 million dollars. The pilot plant test facilities were proposed to have a nominal capacity to process about 1500 pounds per hour of "raw" fly ash. It was anticipated that each 100 ton ash sample would require about a month to be tested and evaluated. The pilot plant direct operating costs were estimated to be about $112,000 per month including raw materials, steam, fuels, power, personnel, services and supplies. In addition, a pilot plant, ash resource and product evaluation program should be expected to also require a strong product market evaluation and test program. The proposed pilot plant is intended to be able to supply sufficient suitably tested sample products to permit a large scale commercial product evaluation program.

25812 **(EPRI-CS—4419-Vol.1) Fly ash design manual for road and site applications. Volume 1. Dry or conditioned placement.** DiGioia, A.M.; McLaren, R.J.; Burns, D.L.; Miller, D.E. (GAI Consultants, Inc., Monroeville, PA (USA)). Feb 1986. 453p. Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303. File Number TI86920207.

This updated design manual describes the use of fly ash as a construction material for use as structural and nonstructural fills, backfills, embankments, base courses, soil stabilization, land reclamation and other high volume uses. The manual details the physical, engineering, and chemical properties of bituminous, subbituminous and lignite fly ash. Included are field and laboratory testing methods, design data, procedures and examples, specifications, quality control, and pre- and post-construction monitoring. Volume 1 describes uses where fly ash is used dry or conditioned with small amounts of moisture. Volume 2 describes uses where fly ash is placed as a slurry with relatively large amounts of water.

25813 **(EPRI-CS—4446) High-volume fly ash utilization projects in the United States and Canada. Final report.** Patelunas, G.M. (GAI Consultants, Inc., Monroeville, PA (USA)). Feb 1986. 217p. Research Reports Centers, Box 50490, Palo Alto, CA 94303. File Number TI86920196.

The purpose of this report is to document existing high-volume applications of fly ash. Examples of high-volume projects are: backfills, embankments, fills, landfill cover, pavement base course, soil amendment, subgrade stabilization, grouts and hydraulic fills. Information was solicited from electric utilities, state highway agencies, ash marketers, engineering firms and other organizations in the United States and Canada. Over 270 separate projects that used fly ash in high-volume applications were identified. Class F fly ash was used in 172 projects, and Class C fly ash was used in 108 projects. The most frequent high-volume use of Class F fly ash was for fills, embankments and pavement base courses. These projects are primarily located in the north central and mid-Atlantic states. The most frequent use of Class C fly ash was for subgrade stabilization. Most of these projects are located in the midwestern and southwestern United States. The existence of many different applications of fly ash documented during this project demonstrates that fly ash is a practical high-volume construction material.

25814 (NP—6751517) International Energy Agency implementing agreement on advanced heat pumps. Annex 3: Heat pump systems applied in industry. Final report. Berghmans, J. (Danmarks Tekniske Hoejskole, Lyngby. Lab. for Koeleteknik). Jun 1985. 296p. NTIS (US Sales Only), PC A13/MF A01. File Number DE86751517.

The application of heat pumps in industry thus far has met only with limited success and this notwithstanding the fact that many industrial processes can be identified in which heat pumps can be applied in principle. Stringent requirements are often put on the heat pump system with respect to its economic performance. Payback values of the investment connected with the heat pump typically are required to be less than 2-3 years. This requires the number of hours of heat pump operation to be rather high (more than 4000) which cannot be met by many industrial processes. Nevertheless heat pumps are presently being applied in a large variety of industrial processes. Most successful are drying applications and heat pumps which satisfy heating and cooling needs simultaneously. The main purpose of the study was to gather information about the application of heat pumps in industry, based upon systems in operation. Information of a technical (coefficient if performance, capacity, fouling,...) as well as of an economic nature (costs of heat pump, installment, maintenance,...) was aimed at. The gathering of information was based upon reports which the participating countries produced and provided to the other participants. The present work represents the final report. The present research and development work related to industrial heat pumps is described in this report together with recommendations for further R and D activities.

25815 (NP—6751627) Experimental project: Heat recovery and CO_2 fertilisation in greenhouse crops. Straelen 1979-1982. A method of energy conservation by means of modern natural gas heating systems. (Landwirtschaftskammer Rheinland, Straelen (Germany, F.R.). Lehr- und Versuchsanstalt fuer Gemuese- und Zierpflanzenbau; Thyssengas G.m.b.H., Duisburg (Germany, F.R.)). Apr 1983. 108p. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE86751627.

Possible techniques for utilizing the exhaust gases of natural gas boilers were investigated with the ultimate aim of lowering the production costs by making use of the heat and CO_2 contained in the exhaust gas. Owing to the extremely low exhaust gas temperatures, waste heat utilization resulted in energy savings of only 2-4%. Another 18.4% were saved by recirculating the residual heat into the greenhouse. Energy savings thus totalled nearly 21%. CO_2 from exhaust gases as a rule increases the natural CO_2 concentrations in greenhouses several times. Even in summer, daily means around 0.15 vol.% of CO_2 were measured. The improved conditions were investigated in 20 different crops. The most startling findings were: 25% shorter growth periods for turnip cabbages, up to 36% higher weight in lettuce, up to 30% higher yields in tomatoes. On average, the economic advantage of energy conservation and higher crop yields resulting from CO_2 fertilisation amounted to DM 0.7/m^3. Uninterrupted CO_2 fertilisation and simultaneous waste heat utilisation are thus clearly proved to improve the economic efficiency of greenhouse crop cultures. (orig./BWI).

25816 (PB—86-146503/XAB) Energy in the wood-processing industry: a manual of energy-conservation practices. Special report. Taylor, R.W. (National Timber Research Inst., Pretoria (South Africa)). Jul 1984. 39p. (CSIR/SR/HOUT—341). NTIS, PC A05/MF A01.

The forms of energy and fuels discussed in the manual are essential to the wood-processing industry. This manual is an attempt to bring together suggestions on ways and means that the wood processing industry, primarily the sawmilling and round-wood-processing industries, could use in setting up their own energy-conservation programs.

25817 (PB—86-151107/XAB) Guide to boiler control and testing equipment. Special report. Gore, W.T. (National Timber Research Inst., Pretoria (South Africa)). Feb 1984. 84p. (CSIR/SR/HOUT—337). NTIS, PC A06/MF A01.

Measurements on 46 boilers in the pulp and paper industry revealed that an average saving of R40 000 per individual boiler per year may be achieved through better control. Two major areas of saving were identified as heat loss up the flue stack and unburnt carbon in the solid boiler residues. A guide to implementing a cost-improvement project is presented. The guide includes practical standard specifications for the individual loss areas and the measured variables. The use of computers is recommended for timeous results. Measuring instruments available in South Africa for gas and residue analysis are listed.

25818 (STU-I—473-1985) Basic energy method. Method for energy analysis and statistics in engineering works. Seden, G.; Andren, O.; Huggare, S. (National Swedish Board for Technical Development, Stockholm). 1985. 85p. (In Swedish). National Swedish Board for Technical Development, Stockholm.

The report deals with a simple method for the calculation of energy conversion inside engineering works. Energy demand is calculated by using the conditions precedent for buildings and operations. The method can be used for energy conservation, statistics, energy comparisons, and distribution.

25819 (SVF—157) Heat pumps and backpressure power. System choice and operation under different conditions in the processing industry. Nord, B.; Sandberg, E. (Stiftelsen foer Vaermeteknisk Forskning, Stockholm (Sweden)). Jun 1984. 39p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. File Number DE86751534.

Whithin the process industry, mainly the pulp and paper industry, there is a opposite relation between use of heat pumps and generation of backpressure power. This report discusses the economics for heat pumps operation respective operation of backpressure turbines at different fuel and heat prices. The relation between operational cost saving and fuel price/heat price is shown in diagrams. The use of backpressure power in the industry today is often not an economic alternative.

3206 Municipalities And Community Systems

REFER ALSO TO CITATION(S) 25365, 25733, 25781, 25810, 25811, 25813

25820 (DOE/CE/30790—T1) Environmental quality assurance for resource recovery with respect to organic emissions. Final report. Tsang, W. (National Bureau of Standards, Washington, DC (USA). Center for Chemical Physics). 1983. Contract AI01-83CE30790. 76p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE86008686.

This report contains the results of work carried out in support of efforts to remove the impediments to the use of municipal solid waste as a solid fuel due to fear of hazardous waste emissions in general and dioxins in particular. It contains three papers, titled: Tracers for Quality Assurance in Municipal Solid Waste Incineration, Hazardous Waste Aspects of Municipal Solid Waste Incinerators, and Scientific Issues Regarding the Origin and Fate of Dioxins and Related Compounds in Energy Recovery Units.

25821 (PB—86-115417/XAB) Municipal waste processing in Europe: a status report on selected materials and energy recovery projects. Abert, J.G. (International Bank for Reconstruction and Development, Washington, DC (USA)). 1985. 173p. NTIS MF A01.

In 1981, a three-year Global Research and Development Project on Integrated Resource Recovery (Waste Recycling) was initiated as Project GLO/80/004 by the United Nations Development Program through its Division for Global and Interregional Projects. The World Bank, through its Water Supply and Urban Development Department (WUD), agreed to act as executing agency. The primary project goal is to achieve economic and social benefits through sustainable resource recovery activities in the developing countries by the recycling and reuse of solid and liquid wastes from municipal and commercial sources. The report deals with municipal waste processing in Europe. It is a status report on selected material and energy recovery projects. It is intended for those readers, primarily from developing countries, interested in the

potential application of industrial country techniques for reuse and recycling of solid wastes.

25822 **(PB—86-131026/XAB) Fate of selected metals and emissions from a sludge/wastepaper gasifier.** Sorbo, N.W.; Tchobanoglous, G.; Lucero, J.D. (California Univ., Davis (USA)). Nov 1985. 184p. NTIS, PC A09/MF A01.

A study was conducted to quantify a pilot-scale sludge and wastepaper gasification system for its gaseous, particulate and metal emissions. The gasifier produced up to 1800 MJ/hr using a fuel mixture of source-seperated wastepaper and sludge. Emissions varied between 15.1 and 16.5 ppm for CO, 1.39 and 12.7 ppm for hydrocarbons, 98.6 and 121 ppm for NOX, and 55.5 and 105 ppm for SO_2. Particulate concentrations varied between 35.70 and 192.96 mg/dry standard cubic meter corrected to 12% CO_2. Metals balance data indicated that Cd, Pb, and Zn increased in concentration (compared to the fuel) in gaseous material leaving the gasifier and that Cu, Cr, and Fe increased in concentration (compared to the fuel) in the char-ashes leaving the gasifier. The particulate emissions in the burned gas from the gasifier were less than the allowable limits for solid-waste incineration.

25823 **(PB—86-135381/XAB) Coal/D-RDF (densified refuse-derived fuel) co-firing project, Milwaukee County, Wisconsin.** Hecklinger, R.S.; Rehm, F.R. (Milwaukee County Government, WI (USA)). Nov 1985. 89p. NTIS, PC A05/MF A01.

A Research and Development Project was carried out to mix a densified refuse-derived fuel with coal at the fuel-receiving point and to co-fire the mixture in a spreader-stoker fired boiler. Two basic series of test runs were conducted. For the first series, coal was fired to establish a base line condition. For the second series, a mixture of coal and densified refuse-derived fuel was fired. The report describes the equipment used to densify refuse derived fuel, procedures used to prepare and handle the coal and densified refuse derived fuel mixture and the test results. The results include the effect of the coal and densified refuse derived fuel mixture on plant operations, boiler efficiency, stack emissions and EP toxicity.

25824 **(STEV-FVE—85-2) Changes in existing and planned heat distribution systems. Reciprocal actions of different steps. A literature survey.** Gustavsson, L. (Statens Energiverk, Stockholm (Sweden)). Oct 1985. 76p. (In Swedish). NTIS (US Sales Only), PC A05/MF A01. File Number DE86751546.

The report is a summary of the literature dealing with district heating and reciprocal action of different steps to improve the system. The study shows that one needs more information about e.g. the used technique related to the flexibility, the utilization ratio, the consequences of the environment and the stability of the energy supply. 59 refs.

25825 **(STEV-FVE—85-3) Economic analysis of heat storage in heat distribution systems.** Margen, P. (Statens Energiverk, Stockholm (Sweden)). Nov 1985. 130p. (In Swedish). NTIS (US Sales Only), PC A07/MF A01. File Number DE86751547.

Different types of storage facilities used in Swedish heat distribution systems are described. The application of heat storage in some district heating systems are studied. The results show that a short time storage gives a very good economy in most of the heat distribution systems. A seasonal storage, or a combination of seasonal and short time storage, is also a good economy, and within 4-7 years the investment is paid.

25826 **(SVF—160) Tests of casing joints for preinsulated district pipes.** Oddving, B. (Stiftelsen foer Vaermeteknisk Forskning, Stockholm (Sweden)). Jun 1984. 40p. (In Swedish). (STUDSVIK-EI—83-202). NTIS (US Sales Only), PC A03/MF A01. File Number DE86751536.

Tests of casing joints for preinsulated district heating pipes have been carried out in a sand box, where a piece of pipe including a casing joint can be moved simulating movements of a pipe burried in the ground. The movements are caused by temperature changes of the water flowing through the steel service pipe. The tests investigate if there exists a certain combination of test parameters, such as the amplitude of oscillations, oscillation velocity, height of the sand bed, properties of the surrounding sand (particle size distribution) and pipe diameter, that will cause the most severe damage to the joint. The tests were performed with two types of jacket joints; the elastic type with mastic coated shrinkable sleeves, and the rigid type with a welded sealing ring at both ends of the joint. Both types had a polyurethane foam insulation. It was found that the sand was the most important factor concerning damages to the joints. Less damages occurred when the height of the sand filling was increased. Two different oscillation velocities have been studied. There is no noticeable difference in the appearance of the damages after completion of tests with the higher and the lower velocity, the damages develop faster at the higher velocity. The damaging process seems to be terminated well before 100 cycles. Some additional tests have been done to study thermal ageing of the jacket joint.

33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS

3301 Internal Combustion Engines

REFER ALSO TO CITATION(S) 25860, 25991

25827 **(AD-A—162658/9/XAB) Fuel-property effects on the unaided cold starting of a two-cycle diesel engine. Interim report, January 1881-December 1985.** Montemayor, A.F.; Owens, E.C. (Southwest Research Inst., San Antonio, TX (USA). Belvoir Fuels and Lubricants Research Facility). Dec 1985. 30p. (BFLRF—186). NTIS, PC A03/MF A01.

In this program, a Detroit Diesel 4-53T was heavily insulated and cooled using a chilled coolant circulation system and cooled combustion air was provided. An external cranking motor was used to turn the engine at a constant rpm. Twenty-one test fuels were blended, and a minimum unaided starting temperature was obtained for each fuel. Multiple linear-regression analysis was then performed in order to relate fuel properties to minimum starting temperature. Fuel properties examined were: viscosity; ASTM D 86 and D 2887 boiling-point temperatures, cetane number, autoignition temperature, and flash point. Cetane number, viscosity, 50% boiling temperature, and autoignition temperature had statistically significant impact on minimum starting temperature.

25828 **(AD-A—163052/4/XAB) Altitude ignition/lean decel study. Final report, August 1983-January 1985.** (Pratt and Whitney Aircraft, West Palm Beach, FL (USA). Government Products Div.). Nov 1985. 88p. (P/W/GPD-FR—18710). NTIS, PC A05/MF A01.

The objective of this study was to develop analytical tasks consisting of new or improved models for predicting altitude ignition and lean-deceleration blowout. The approach taken was to describe the ignition and flame-stabilization limits in terms of characteristic time models. Characteristic times associated with chemical kinetics, fuel evaporation, and hot-flow residence are quantified for ignition and lean-deceleration blowout limits. These expressions were interrelated according to the criteria for successful ignition and flame stabilization. Statistical analysis was used to compare the various expressions and select the appropriate terms in formulating models that best fit the data for altitude ignition and lean deceleration blowout. The models linearly correlate variations in combustor pressure, inlet temperature, fuel-air ratio, fuel temperature, air velocity, pressure drop, combustor front-end geometry and injector size using existing data from USAF, Navy, NASA and P&W sponsored programs on operability performance of military and commercial gas turbine combustors. These models were based entirely on full scale engine tests.

25829 **(CONF-850254—4) 1985 SAE Congress on the intact core of full-cone sprays.** Chehroudi, B.; Chen, Shih-Hsiung; Bracco, F.V. (Princeton Univ., NJ (USA). Dept. of Mechanical and Aerospace Engineering; Toyohashi Univ. (Japan)). 1985. Contract AC04-81AL16338. 10p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86008175.

From SAE international congress and exhibition; Detroit, MI, USA (27 Feb 1985).

A voltage was applied between the nozzle unit and fine needles, rods, and screens inserted at various axial and radial positions into atomizing full-cone water sprays and the corresponding electrical resistance was measured in an attempt to determine the shape and length of the intact liquid core. The parameters of the experiment were: room temperature; air compressed at 0.1, 1.0, and 2.9 MPa; injection $\Delta p = 13.7$ MPa; and five straight-hole nozzles with diameters of 127, 178, 305, 343, and 508 μm, and the same length-to-diameter ratio of 4. The results show that current is carried not only by intact liquid cores but also by atomized unconnected sprays and even across such sprays. Thus the shape of the intact core could be reduced only in the vicinity of the nozzle exit. In the atomization regime, the length of the intact core is found to be proportional to the nozzle diameter and to increase as the square root of the liquid-to-gas density ratio, i.e. x_1 = Cd(rho/sub £/rho/sub g/)/sup 1/2/ where c = 7. 9 figs.

25830 **(MIRA—86/01/XAB) Robotic driver for emissions, fuel consumption, and drive-line testing.** Willn, J.E.; Forbes, R.T.; Oberoi, S.N.; Patullo, J.S. (Motor Industry Research Association, Nuneaton (UK)). 1985. 29p. NTIS, PC A$14.00/MF $14.00.

A robotic drive-cycle controller was developed for controlling automatic and manual-gear-change passenger vehicles during tests on roller dynamometers. The controller comprises a five-channel electro-hydraulic actuator system located in an adjustable supporting frame, controlled from a dedicated micro-computer.

25831 **(ORNL/TM—9554) Application of the adiabatic diesel to heavy trucks: a technology assessment.** Graves, R.L.; Greene, D.L.; Gregory, E.W. II. (Oak Ridge National Lab., TN (USA)). Mar 1986. Contract AC05-84OR21400. 98p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE86008940.

This document describes the details and results of the analyses and assessments which were used extensively in planning the DOE Heavy Duty Transport Technology (HDTT) Program. The HDTT Program focuses research and development on technology that would lead to a commercially viable low-heat-rejection ("adiabatic") diesel engine for heavy trucks. ORNL was asked to forecast the impact of this advanced engine on fuel consumed by the heavy truck sector and to determine whether indeed the adiabatic diesel had potential. Furthermore, key research topics were to be identified which, when investigated, would eliminate serious technical barriers to the realization of this concept.

25832 **(PB—86-143963/XAB) Fuel consumption and emission values for traffic models. Final report, January 1982-May 1985.** McGill, R. (Oak Ridge National Lab., TN (USA)). May 1985. 93p. NTIS, PC A05/MF A01.

The report documents the methodologies used in the development of fuel consumption and emission maps for 15 passenger vehicles representative of 64% of the 1980-1992 population. From the results of the study, the Federal Highway Administration is currently updating the fuel consumption and emission estimation algorithms in traffic models such as NETSIM and TRANSYT-7F. These results include tables and graphs that relate fuel consumption and emissions to vehicle speed and acceleration. The major achievement of this study was the capability of combining laboratory (dynamometer) testing with on-road testing to assess the energy and environmental characteristics of passenger vehicles as they operate in real-world conditions.

3303 Electric-powered Systems

25833 **(DOE/CS/51042—T8) Verification and product-improved tests of the South Coast Technology R-1 Electric Rabbit.** Dowgiallo, E.J. Jr.; Snellings, I.R.; Blake, W.H. (Army Mobility Equipment Research and Development Command, Fort Belvoir, VA (USA). Electrical Power Lab.). Nov 1980. Contract AI01-77CS51042. 50p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86008277.

The US Army Mobility Equipment Research and Development Command is tasked with the responsibility for the testing and evaluation of electric and hybrid vehicles for the Department of Energy, under provisions of Public Law 94-413. Performance Standards for such vehicles are defined in Title 10, Chapter II, Article 475 of DOE Rules and Regulations, dated 3 July 1978. These rules and regulations are published in the Federal Register, Part V, dated 30 May 1978 (see Appendix A). MERADCOM has tested several such vehicles under this program and has published performance reports on these vehicles as unrestricted public information. Because the vehicle was certified by the manufacturer to meet DOE performance standards it was tested by MERADCOM. This report presents acceptance and verification test results.

25834 **(DOE/CS/51042—T11) Baseline tests of the Electra Van Model 1000 Electric Vehicle.** Dowgiallo, E.J. Jr.; Snellings, I.R.; Blake, W.H.; Krause, K.F. (Army Mobility Equipment Research and Development Command, Fort Belvoir, VA (USA). Electrical Power Lab.). Jul 1980. Contract AI01-77CS51042. 68p. NTIS, PC A04/MF A01. File Number DE86008280.

The Electra Van Model 1000 is a vehicle manufactured by Jet Industries Inc.; 4201 South Congress Ave; Austin, Texas 78745. The vehicle was tested under the direction of the US Army Mobility Equipment Research and Development Command (MERADCOM) between 20 September 1978 and 28 November 1978. The tests are part of a Department of Energy (DOE) project to assess the state-of-the-art of electric vehicles and to verify manufacturers self-certifications that vehicles offered to DOE site operations meet DOE performance standards. The Jet Electra Van 1000 is a Dodge Van converted to an electric vehicle which can hold two passengers plus cargo. The vehicle does not have regenerative braking. The parameters, symbols, units, and unit abbreviations used in this report are given. The results of the tests are summarized.

3306 Vehicle Design Factors

25835 **(VTT-TIED—395) Oil hydraulics in arctic regions.** Vainio, H.; Lehmusto, M.; Mikkonen, S. (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)). Dec 1984. 37p. (In Finnish). NTIS (US Sales Only), PC A03/MF A01. File Number DE86751569.

Oil hydraulics in arctic conditions has been studied. Seals, oils and hydraulic motors were tested down to the temperature -50 deg C. Some seals operated satisfactory at the temperature -50 deg C when lightly loaded. Because of good viscosity properties the hydraulic oils used for aeroplanes are well suited for use in cold environments. High speed low torque-hydraulic motors operated satisfactory in cold environment. A hydraulic system of a cargo hatch in an arctic vessel was tested in a cold room. The effects of large differences in temperature must be taken into account when planning hydraulic systems.

25836 **(VTT-TIED—489) Testing of a hydraulic system at low temperatures.** Soudunsaari, R.; Chersky, J.; Popov, S.; Kulagin, V. (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)). Sep 1985. 42p. (In Finnish). NTIS (US Sales Only), PC A03/MF A01. File Number DE86751570.

The function of a hydraulic system was studied in arctic conditions. The ambient temperature varied between -25 - -52 deg C during the tests. The heating up of the oil in the tank was studied at power losses of 1.6 - 9.8 kW. The temperature decrease of the oil during the night was measured with the tank uncovered, covered with a fabric and isolated. The temperature increase of the oil was studied by heating it for two hours by an oil heater. It is possible to raise the oil temperature with an oil heater to ensure the starting of the pump. Static and dynamic tests of seals were made with single and double acting cylinders. Static tests were carried out with cold as well as warms seals. Before the static tests with warm seals started the pistons were driven back and forth. Leakages occured in all the piston or piston rod seals. The leakages normally increased when the ambient temperature decreased. Seals made of normal nitrile rubber were unsuitable in low temperature usage. The ability of six scrapers to remove frost and ice from the piston rod was evaluated. The leakage through shaft lip seals and static seals of two hydraulic motors was studied. Warm oil fed into cold hydraulic motors did not affect the function of the motors.

3307 Emission Control

REFER ALSO TO CITATION(S) 25830, 25832, 25851, 26232, 26251

25837 (KFK-PEF—2, pp 613-630) **Determination of representative engine characteristics for passenger motor cars.** Benz, T.; Axhausen, K. (Karlsruhe Univ., T.H., Germany, F.R. Inst. fuer Verkehrswesen). Apr 1985. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86751479. (CONF-8503225—).

From 1. status colloquium of the European Research Center project for air pollution abatement measures (PEF) of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (5 Mar 1985).

The fact that traffic contributes to the problems of energy consumption and environmental pollution, hardly needs to be underlined. Some figures published by the Federal Minister of the Interior (1983) are tell-tale. In 1982, 8.2 mil. tonnes carbon monoxide were emitted in the Federal Republic of Germany out of which 65% are attributed to traffic. 54.6% out of the total emission of 3.1 mil. tonnes nitrogen oxides are attributed to traffic. However, other groups of emitters dominate the picture concerning other pollution components. Three approaches are adopted in order to improve conditions - engine and/or vehicle technology, legislation, traffic engineering. In principle, exhaust-gas regulations and legislation will have effects on engine and vehicle technology, whereas traffic engineering will be effective always independent of the other two approaches. (orig.).

25838 (PB—86-141785/XAB) **Study of gasoline volatility and hydrocarbon emissions from motor vehicles. Technical report.** (Environmental Protection Agency, Ann Arbor, MI (USA)). Nov 1985. 337p. (EPA/AA/SDSB—85/5). NTIS, PC A15/MF A01.

In-use motor-vehicle evaporative-hydrocarbon emissions greatly exceed their applicable EPA emission standards. The primary reason is that the volatility of commercial gasoline is substantially greater than that of the certification test fuel specified by EPA (i.e., vehicles are simply not designed to handle the fuel volatility they regularly experience). The long-term solution is to equate the volatilities of commercial and certification test gasolines. This can be done at: (1) the current volatility of commercial gasoline, (2) that of certification test gasoline, or (3) at some point in between. However, in the short term, only the reduction of commercial gasoline volatility has a significant environmental benefit, since the effect of certification fuel modifications must await the turnover of the vehicle fleet. This study examines the technological feasibility, costs, emission reductions, air-quality impacts and cost-effectiveness of the various long-term and short-term solutions to this problem.

25839 (PB—86-142007/XAB) **Supplementary guidelines for lead implementation plans: updated projections for motor vehicle lead emissions. Final report.** (Energy and Environmental Analysis, Inc., Arlington, VA (USA)). Aug 1985. 41p. NTIS, PC A03/MF A01.

The document is an update to Supplementary Guidelines for Lead Implementation Plans Updated Projections for Motor Vehicle Lead Emissions, U.S. EPA, EPA-450/2-83-002, Research Triangle Park, North Carolina, March 1983. (PB 84-104603). It provides updated projections for automotive lead emissions to be used by those agencies developing State Implementation Plans for lead. It was revised to include estimates of travel fractions and fleet characterizations from the June 1984 EPA report, User's Guide to OBILE3 (Mobile Source Emissions Model), EPA 460/3-84-002. (PB 84 213974). It also reflects the final rulemaking recently issued by EPA which requires refiners to lower the lead content of leaded gasoline to 0.5 g/gallon on July 1, 1985 and 0.1 g/gallon by January 1, 1986 (Federal Register, Vol. 50, No. 45, March 7, 1985).

25840 (PB—86-143872/XAB) **Tech 4 Credit Model: estimates for emission factors and inspection and maintenance credits for 1981 and later vehicles for MOBILE3. Technical report.** Brzezinski, D.J. (Environmental Protection Agency, Ann Arbor, MI (USA). Emission Control Technology Div.). Oct 1985. 60p. (EPA/AA/IMG—85/6). NTIS, PC A04/MF A01.

The report provides the basis for the equations used in MOBILE3 to predict the emission levels of 1981 and newer gasoline-powered light-duty passenger vehicles. This was done by characterizing the performance of vehicles in the Emission Factor data base separately for several technology types, such as fuel-injected versus carbureted, and recombining the technologies based on projected mixes to produce estimates of emissions of future model years. The Tech IV Credit Model is the computer software developed to calculate the MOBILE3 emission factor estimates. In addition, the model was used to estimate the emission reductions due to Inspection and Maintenance (I/M) programs for these vehicles. The emission levels of vehicles in the sample identified by various test type and cutpoint combinations were reduced to reflect repairs due to the I/M program. After combining the repaired and unrepaired vehicle emission levels, the overall reduction from the non-I/M base case is expressed as a fraction of the base case. This reduction fraction is scored in MOBILE3 and used to estimate fleetwide reductions due to I/M programs.

25841 (VW-FMT—8406-V/5) **Formation of artefacts during sampling of diesel particles.** Hartung, A.; Kies, H. (Volkswagenwerk A.G., Wolfsburg (Germany, F.R.)). May 1984. 26p. (In German). NTIS, PC EVolkswagenwerk A.G., Wolfsburg (Germany, F.R)$TIB/A86-03432 PC: E02; Available from NTIS as TIB/A86-03432.

In the discussion about diesel exhaust gas press releases have directed the interest on nitroderivates of polycyclic aromatic hydrocarbons (nitro-PAH). It is not yet known whether the nitroderivates measured are produced during combustion or only whether they are artificially generated during sampling. (so-called formation of artefacts). A no method of artifact-free sampling exists this question couldnt have been answered directly yet. The sampling system developed here allows to answer this question indirectly, by correlating the nitro-PAH-concentration at the particulates and the sampling time. Even in very short collection times (one minute and more) enough particulates were found for nitro-PAH-analysis. Tests made with three VW/Audi vehicles showed that under conditions of the Federal Test Procedure artefact-formation during filter collection of diesel particulates was less than 20% of the 1-nitropyrene found at the particulates. The greater part of the nitro-PAH seems to have been formed in the engine and/or the outlet system. This statement so far only applies to the vehicles of this test and the corresponding ambient conditions. Artifact formation can increase under operation conditions with higher NO_2-concentrations or longer collection time. A formula of kinetic reaction is given which allows to estimate to what extent artifacts are formed. The estimates agree well with the values measured here. (DOMA).

3308 Alternative Fuels

25842 (DOE/CE/50070—T10) **DOE synthetic fuel center operation. Monthly progress report No. 5, 1 March-31 March 1986.** Sefer, N.R.; Erwin, J. (Southwest Research Inst., San Antonio, TX (USA). Fuels and Lubricants Research Div.). 10 Apr 1986. Contract AC01-84CE50070. 7p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86009062.

The mission of the Synthetic Fuel Center is to provide test quantities of special fuels to the research projects of the AFUP. The fuels have met defined composition and property objectives or have conformed to assessments of future fuel composition. These fuels are produced from divers sources including shale, coal, tar sands, and petroleum stocks and have included alcohols and vegetable oils. In the first three years of operation, the Center completed the laboratory and pilot plant, provided 26 fuels to 11 AFUP projects, and made two presentations of its work and five roundtable discussions.

25843 (DOE/OR/21400—T200) **Optimizing diesel fuel composition.** Compere, A.L.; Griffith, W.L. (Oak Ridge National Lab., TN (USA)). 1980. Contract AC05-84OR21400. 14p. NTIS, PC A02/MF A01. File Number DE86002256.

A series of charts and tables is provided concerning the use of alcohol fuels in automobiles. 5 figs., 5 tabs.

25844 **(PB—86-127818/XAB) Technical survey of CNG (compressed natural gas) vehicles.** Jones, K.; Raine, R.R.; Stephenson, J. (New Zealand Energy Research and Development Committee, Auckland). Feb 1985. 27p. (REPT—113). NTIS, PC A03/MF A01.

The report describes the findings of a non-random selection survey undertaken to assess the performance standard and level of public satisfaction with CNG-powered vehicles. A total of 65 vehicles from the Auckland area was evaluated covering most of the popular models and CNG conversion systems.

36 MATERIALS

25845 **(DOE/ER/45115—2) Microstructural effects in solid-particle erosion. Progress report, January 1, 1985-January 1, 1986.** Conrad, H.; Scattergood, R. (North Carolina State Univ., Raleigh (USA). Dept. of Materials Engineering). 1986. Contract FG05-84ER45115. 213p. NTIS MF A01; 2; GPO Dep. File Number DE86008211.

The following were studied: particle feed rate effects during erosion testing; erosion of WC-Co alloys; erosion studies on composites, ceramics, and stainless steel; erosion of SiC reinforced alumina; and erosion mechanisms in Al and Al-Si alloys. (DLC)

25846 **(ORNL—6129) Mathematical modeling of laser induced ultrarapid melting and solidification.** Alexiades, V.; Drake, J.B.; Geist, G.A.; Giles, G.E.; Solomon, A.D.; Wood, R.F. (Oak Ridge National Lab., TN (USA)). Mar 1986. Contract AC05-84OR21400. 52p. NTIS, PC A04/MF A01; GPO Dep. File Number DE86008482.

Mathematical and numerical aspects of laser induced phase change modeling are discussed. Several numerical formulations, including explicit and implicit enthalpy, adaptive grid finite volume and front tracking are derived and results are presented. In addition, a novel hyperbolic formulation is explored analytically and numerically. The explicit enthalpy approach allows the greatest flexibility and efficiency in modeling problems with complicated phase transitions. The LASER8 program is described.

3601 Metals And Alloys

REFER ALSO TO CITATION(S) 25274, 25510, 25529, 25544, 25561, 25564, 25632, 25664, 25665, 25685, 25686, 25703, 25704, 25806, 25807, 25808, 25950, 25989, 25990, 26003, 26447, 26450, 26717, 26717, 26738

25847 **(CONF-860421—16) Corrosion of Fe-Cr-Mn alloys in thermally convective lithium.** Tortorelli, P.F.; DeVan, J.H. (Oak Ridge National Lab., TN (USA)). 1986. Contract AC05-84OR21400. 16p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86009153.

From 2. international conference on fusion reactor materials (ICFRM-2); Chicago, IL, USA (13 Apr 1986).

A series of austenitic Fe-Cr-Mn steels was exposed to circulating lithium at temperatures up to 500°C. Two groups of the alloys, which contained 12 to 30 wt % Mn and 2 to 20 wt % Cr, were sequentially exposed for periods greater than 3000 h in a type 316 stainless steel thermal convection loop. Mass transfer of manganese caused very large weight losses from the steels containing 30 wt % Mn. However, the actual magnitude of corrosion losses for alloys containing 12 to 20 wt % Mn was difficult to establish due to competing surface reactions involving chromium.

25848 **(CONF-860421—18) Effect of neutron irradiation on vanadium alloys.** Braski, D.N. (Oak Ridge National Lab., TN (USA)). 1986. Contract AC05-84OR21400. 28p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86009156.

From 2. international conference on fusion reactor materials (ICFRM-2); Chicago, IL, USA (13 Apr 1986).

Neutron-irradiated vanadium alloys were evaluated for their susceptibility to irradiation hardening, helium embrittlement, swelling, and residual radioactivity, and the results were compared with those for the austenitic and ferritic stainless steels. The VANSTAR-7 and V-15Cr-5Ti alloys showed the greatest hardening between 400 and 600°C while V-3Ti-1Si and V-20Ti had lower values that were comparable to those of ferritic steels. The V-15Cr-5Ti and VANSTAR-7 alloys were susceptible to helium embrittlement caused by the combination of weakened grain boundaries and irradiation-hardened grain matrices. Specimen fractures were entirely intergranular in the most severe instances of embrittlement. The V-3Ti-1Si and V-20Ti alloys were more resistant to helium embrittlement. Except for VANSTAR-7 irradiated to 40 dpa at 520°C, all of the vanadium alloys exhibited low swelling that was similar to the ferritic steels. Swelling was greater in specimens that were preimplanted with helium using the tritium trick. The vanadium alloys clearly exhibit lower residual radioactivity after irradiation than the ferrous alloys.

25849 **(CONF-860540—1) Corrosion of iron in (Li/sub 0.62/K/sub 0.38/)$_2$CO$_3$ at 650°C.** Hsu, H.S. (Oak Ridge National Lab., TN (USA)). Dec 1985. Contract AC05-84OR21400. 3p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86004803.

From 169. meeting of the Electrochemical Society; Boston, MA, USA (4 May 1986).

The rapid progress in the development of molten carbonate fuel cells (MCFCs) has highlighted the problem of material compatibility with molten carbonates. Phase stability diagrams were developed for the Cr-Li-K-C-O and Fe-Li-K-C-O systems, and the corrosion of chromium in (Li/sub 0.62/K/sub 0.38)$_2$CO$_3$ was studied at 650°C. This paper presents subsequent results on the corrosion of iron under a deposit of the eutectic composition of (Li/sub 0.62/K/sub 0.38)$_2$CO$_3$ in simulated fuel cell environments at 650°C.

25850 **(CONF-860585—2) Dynamic fracture analysis of HSST crack run-arrest experiments with nonisothermal wide plates.** Bass, B.R.; Pugh, C.E.; Naus, D.J. (Oak Ridge National Lab., TN (USA)). 1986. Contract AC05-84OR21400. 6p. NTIS, PC A02/MF A01 - GPO. File Number TI86007868.

From International conference on computational mechanics; Tokyo, Japan (25 May 1986).

Dynamic fracture analysis results from Heavy-Section Steel Technology (HSST) wide-plate crack-arrest tests are summarized. These tests relate to assessing nuclear reactor pressure vessel integrity under pressurized-thermal-shock (PTS) conditions. Computed results for five tests are compared with measurements of strain versus time, crack propagation speed, and the arrest location. Crack arrest toughness values determined by various analytical methods are compiled for test temperatures that range from mid-transition into the Charpy upper-shelf region for the test material.

25851 **(CONF-8510103—7) Zirconia to cast iron brazing for uncooled diesel engines.** Santella, M.L.; Hammond, J.P.; David, S.A.; Simpson, W.A. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 8p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86008982.

From Automotive technology development contractors' coordination meeting; Dearborn, MI, USA (20 Oct 1985).

Partially stabilized zirconia has been successfully brazed to nodular cast iron by the active substrate process. The process involves coating the ceramic with an agent that promotes wetting and allows the use of commercially available ductile brazing alloys. Process details and the microstructure of zirconia-cast iron joints are described. A method of testing the shear strength of braze interfaces is outlined, and data for zirconia interfaces tested at 25 and 400°C are presented. Joints between zirconia and cast iron or titanium develop shear strengths typically in excess of 130 MPa at 25°C, but strength at 400°C is lower. The reduced strength is related to porosity in the braze joints, and a means of eliminating this porosity is discussed. Preliminary observations indicate that aging at 400°C produces no major microstructual changes in the braze joints. Also, the brazing of 115-mm-diameter discs of zirconia and cast iron, and the nondestructive examination of these brazements, is discussed.

25852 **(DOE/ER/10107—31) Microstructural characterization of PCA-type splat-quenched foils of austenitic stainless steels irradiated in the HFIR to 14 dpa, 750 appm He.** Capano, M.A.; Hobbs, L.W.; Kohse, G.; Grant, N.J.; Harling, O.K. (Massachusetts Inst. of Tech., Cambridge (USA)). 1986. Contract AC02-78ER10107. 26p. (CONF-860421—12). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86009048.

From 2. international conference on fusion reactor materials (ICFRM-2); Chicago, IL, USA (13 Apr 1986).

The results of microstructural characterization of rapidly-solidified (RS) foils irradiated in the High Flux Isotope Reactor (HFIR) to 14 dpa/750 appm He at 773 K and 873 K are reported. RS foils with nominal Ti and C concentration of 1, 3 and 5 times the amount contained in prime candidate (PCA) stainless steels (0.32 Ti, 0.046 C) were prepared and three thermomechanical treatment were employed to obtain variations in the pre-irradiation microstructures. Quantitative electron microscopy results for void swelling, dislocation structure, radiation-induced phase transitions and segregation of defects/He to interphase boundaries are discussed. Higher swelling was found at 773 K compared to 873 K and in annealed materials, consistent with a model for swelling suppression based on thermal and recoil re-solution precipitation effects. Voids were not found at particle/matrix interfaces. Under the conditions of this experiment, RS processing and increased Ti and C did not significantly alter the swelling behavior.

25853 **(DOE/ER/45096—T1) Stability of amorphous metal films on semiconductor substrates. Progress report, January-December 1985.** Wiley, J.D.; Perepezko, J.H. (Wisconsin Univ., Madison (USA)). 15 Jan 1986. Contract FG02-84ER45096. 17p. NTIS, PC A02. File Number DE86008836.

The primary goals for the second year involved overlayer and substrate studies. These studies have concentrated on two amorphous alloy systems: the Ni-Nb system (a transition metal-transition metal system) and the W-Si system (a metal-metalloid system). Considerable progress has been made in the identification of reactive overlayer/amorphous alloy/substrate combinations and in understanding the reaction paths and mechanisms of specific systems.

25854 **(DOE/NASA—0563-1) Effect of boron on tensile properties of B2 FeAl.** Crimp, M.; Vedula, K. (Case Western Reserve Univ., Cleveland, OH (USA)). Feb 1986. Contract AI01-77CS51040. 15p. (NASA-CR—175074). NTIS, PC A02/MF A01. File Number TI86008577.

Small additions of boron improve the room temperature ductility of Ni_3Al, possibly owing to B segregation to grain boundaries. This study was undertaken to see if boron has a similar effect on the low temperature tensile properties of FeAl. A binary alloy without boron is compared with an alloy containing 0.78 at % B (0.2 wt %), by tensile testing over the temperature range of 300 to 640°K. Both alloys were processed by powder metallurgy. Results showed that 0.78 at % B addition to FeAl does indeed change the room temperature fracture mode from intergranular to transgranular, suggesting a strengthening of grain boundaries. The alloy containing boron is, however, still brittle at room temperature. A slight decrease in the ductile to brittle transition temperature is, nevertheless, observed. In addition a significant increase in strength of the alloy is observed with boron addition.

25855 **(DP-MS—85-2) Chloride stress corrosion cracking of insulated austenitic stainless steel: solar heating considerations.** Peters, J.J.; Jenkins, C.F. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). 1986. Contract AC09-76SR00001. 21p. (CONF-860304—6). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86008907.

From Corrosion '86; Houston, TX, USA (17 Mar 1986).

Chloride stress corrosion cracking (CSCC) of insulated pipe systems is discussed, and sources of chloride ions, moisture, and temperature increases in an industrial environment are considered. A recent CSCC failure of above-ground insulated austenitic stainless steel piping at the Department of Energy's Savannah River Plant (SRP) prompted investigation of the subject. Tests were run to establish pipe surface temperatures and temperature variations beneath thermal insulation during normal operation and under idle conditions. The effects of temperature on the pipe surface by sustained solar heating and unregulated electrical heat tracings were determined. The surface temperatures exceeded 54°C (130°F) on a sunny summer day. SRP design requires consideration of CSCC at 40°C (104°F), prompting the need for preventive methods to avoid failure above 40°C whenever stainless steel and chlorides occur simultaneously. Recommended preventive techniques are discussed.

25856 (JAERI-M—83-226, pp 44-53) **Anisotropy of displacement threshold energies calculated by the molecular dynamical method.** Yokota, Terufumi; Taji, Yukichi; Iwata, Tadao. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). Jan 1984. (In Japanese). NTIS (US Sales Only), PC A06/MF A01. File Number DE86780432. (CONF-830197—).

From Workshop on computer simulation of atomic collision processes in solids; Tokyo, Japan (27 Jan 1983).

The computer experiment concerning the anisotropy in the displacement threshold energy of molybdenum was performed. The GRAPE code made by Vineyard et al. was used for the study. Three kinds of forces are applied on a crystal surface. The first one is a constant force to stabilize the crystal, the second is the force proportional to the surface displacement, and the third the damping force proportional to the velocity of a surface particle. The two body central force potential is based on that used by Johnson and Wilson. It was found that the direction of dumbbell of interstitial atoms played an important role for the stability of the Frenkel pair. The calculation of the knock-out threshold energy was performed for all the direction. The existence of the simple direction and the complicate direction is important for the bcc metal.

25857 **(KAPL—4190) Effective tearing modulus: a model for brittle fracture and tearing instability.** MacDonald, B.D. (Knolls Atomic Power Lab., Schenectady, NY (USA)). Mar 1986. Contract AC12-76SN00052. 38p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86008785.

The objective of this study was to determine a model for the transition regime and upper shelf fracture resistance of low-strength/high-toughness structural steels. The success of the model was measured in two ways: (1) the condition for fracture specimen maximum load, intersection of applied and material effective tearing modulus curves, was satisfied for compact tension data in the transition and upper shelf fracture regimes; (2) maximum load attained by surface-flawed intermediate test vessels (ITV's) was accurately calculated by using the model and associated compact tension data. The fracture model attribute of stress-dependent plastic zone constraint was thought to be primarily responsible for its thickness insensitivity. Metallurgical fracture mode insensitivity of the model in the transition regime was thought to be primarily due to the use of a plastic zone addition to the physical crack size. Calculation of the fracture model parameters (crack driving/resistance forces and their derivatives with respect to the plastic-zone-corrected crack) was enhanced by the availability of and relationship to linear elastic fracture mechanics formulas. Ligament size criteria consistent with the fracture model were determined empirically for the compact tension specimen. Pressure vessel analyses indicated that model accuracy was acceptable provided that the average hoop stress was less than the yield stress.

25858 **(KFK—3975) 1000 h investigations of iodine induced corrosion performed on selected stainless steel specimens under simulated dissolver conditions.** Amend, J.; Dillmann, H.G.; Furrer, J.; Kaempffer, R. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Lab. fuer Aerosolphysik und Filtertechnik 1; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Wiederaufarbeitung und Abfallbehandlung). Sep 1985. 26p. (In German). (PWA—53/85). NTIS (US Sales Only), PC A03/MF A01. File Number DE86751090.

The results are presented of a novel technique for extended time investigations of iodine induced corrosion performed on selected stainless steel specimens in the presence of NOsub(x). Under the specified corrosion conditions of the dissolver offgas (4 g iodine/m^3 and 1 vol.% NOsub(x)) the materials 1.4539 and 1.4563 have stood

the test. For the material 1.4306 pitting corrosion was found after 600 h of exposure in the condensation phase. These extreme long-time effects were not recorded by the potentiokinetic investigation made in parallel because the latter experiment covered much shorter periods of time. (orig.).

25859 **(LA-UR—86-1048) Swelling of spinel after low-dose neutron irradiation.** Coghlan, W.A.; Clinard, F.W. Jr.; Itoh, N.; Greenwood, L.R. (Los Alamos National Lab., NM (USA); Nagoya Univ. (Japan). Dept. of Crystalline Materials Science; Argonne National Lab., IL (USA)). 1986. Contract W-7405-ENG-36. 21p. (CONF-860421—8). NTIS, PC A02/MF A01; GPO Dep. File Number DE86008753.

From 2. international conference on fusion reactor materials (ICFRM-2); Chicago, IL, USA (13 Apr 1986).

Swelling was determined in samples of single-crystal $MgAl_2O_4$ spinel, irradiated to doses as high as 8 x 10^{22} n/m^2 (E > 0.1 MeV) at $\approx$50°C in the Omega West Reactor. Swelling effectively saturated at $\approx$2 x 10^{22} n/m^2 which corresponds to a damage level of only $\approx$2 x 10^{-3} dpa. In addition subsequent measurements after irradiation have revealed that the samples continued swelling for several weeks. These results imply that irradiation defects begin to interact by recombination and aggregation at low damage levels in this material at 50°C and perhaps continue to cluster at room temperature after irradiation. Rate equations have been employed to determine defect concentrations at saturation. Results to date show that the observed swelling is consistent with the number of surviving defects if swelling per Frenkel defect pair is taken to be one atomic volume.

25860 **(PB—86-122223/XAB) Nippon Kokan technical report, No. 108, July 1985.** (Nippon Kokan K.K., Tokyo). 1985. 102p. NTIS, PC A05/MF E01.

Contents include: countermeasures to save energy of sintering plant and future plans in fukuyama works; improvement of surface quality of continuous-casting slab; development of direct quenching and tempering type HT80 steel with good weldability; numerical analysis of fluid flow in a geothermal reservoir; the finite-element calculation of turbulent flow using the universal law of the wall; development of PC 4 dual fuel engine; design of industrialized housing; Computer-aided Navigation system (CANSY); and new production control system in Fukuyama Works.

25861 **(PNL-SA—13135) Computer simulation of dislocation production and recovery for irradiated metals.** Henager, C.H. Jr.; Simonen, E.P. (Pacific Northwest Labs., Richland, WA (USA)). Dec 1985. Contract AC06-76RL01830. 14p. (CONF-8510160—15). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86007727.

From ASM metals congress/TMS-AIME fall meeting; Toronto, Ontario, Canada (13 Oct 1985)

The effect of the thermal stability of interstitial dislocation loops on the hardening-softening transition temperature of irradiated metals was explored with a simple computer model. Destabilizing the interstitial loop population by simulating spontaneous thermally activated unfaulting reduced the hardening-softening transition temperature significantlyulated loop unfaulting shifted the transition temperature down 50°K for both annealed and cold-worked microstructures. Interstitial loop growth, loop coalescence with network dislocations, and network recovery were simulated using rate equations. Simple expressions for dipole recovery, dislocation intersections, and loop population behavior were developed. The model correctly predicts typical trends observed in irradiated metals. These trends include saturation of the dislocation density at high irradiation doses and a decrease in loop density with increasing irradiation temperature. However, the model underestimates the total loop densities and, therefore, the magnitude of the predicted strengths and softening temperatures are less than observed.

25862 **(UCRL—93492) Irradiation disordering and ordering of Cu_3Au by fusion neutrons.** Huang, J.S.; Guinan, M.W.; Hahn, P.A. (Lawrence Livermore National Lab., CA (USA)). 18 Mar 1986. Contract W-7405-ENG-48. 20p. (CONF-860421—6). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86008771.

From 2. international conference on fusion reactor materials (ICFRM-2); Chicago, IL, USA (13 Apr 1986).

Ordered and partially ordered Cu_3Au alloys (S = .30 - .99) have been irradiated at 4K and 300K with fusion neutrons at RTNS-II. The disordering rate was measured by monitoring electrical resistivity. The analysis of 4K irradiations and a comparison with fission reactor irradiations indicated that the disordering rate depended upon the long-range order parameter, S, dS/d phi t = - $S(k_1-k_2S)$, where k_1 and k_2 are scaled with damage energy. The results of 300K irradiation indicated that reordering competed significantly with disordering in the partially ordered sample. Compared to the results of 4K irradiation, the net disordering rate at 300K was higher than that at 4K. This difference and the dependence of disordering rate on S is discussed in terms of the effects of disorder and thermal displacements on cascade cooling processes.

25863 **Hugoniot measurements for vanadium.** Gathers, G.R. (University of California, Lawrence Livermore National Laboratory, Livermore, California 94550). *Journal of Applied Physics;* **59**: No. 9, 3291-3293(1 May 1986). Contract W-7405-ENG-48.

The Hugoniot of vanadium has been measured by means of a two-stage light-gas gun which launches planar impactors at velocities up to 8 km/s. The data fit the relation U/sub s/ = C+S U/sub p/, where U/sub s/ is shock velocity, U/sub p/ is particle velocity, C = 5.044 km/s, and S = 1.242 in the pressure range 20—337 GPa.

25864 **Cesium coverage on molybdenum due to cesium ion bombardment.** Tompa, G.S.; Carr, W.E.; Seidl, M. (Department of Physics and Engineering Physics, Stevens Institute of Technology, Hoboken, New Jersey 07030). *Applied Physics Letters;* **48**: No. 16, 1048-1050(21 Apr 1986).

Cesium coverage due to Cs^+ bombardment of a polycrystalline molybdenum surface was investigated in the incident energy range below 500 eV. When the surface is exposed to a Cs^+ beam the work function decreases until steady state is reached with a total dose of less than roughly-equall x 10^{16} ions/cm^2. The steady state work function reaches a minimum at an incident energy of roughly-equal100 eV and slowly increases with bombarding energy. Cesium coverage of a target is proportional to the ratio $(1-\beta)/\gamma$, where β is the reflection coefficient and γ is the sputter yield. This ratio is large for molybdenum because of its low mass and high binding energy. Implications of these results for H^- surface conversion sources are discussed.

25865 **Trapping of deuterium in krypton-implanted nickel.** Frank, R.C.; McManus, S.P.; Rehn, L.E.; Baldo, P. (Physics Department, Augustana College, Rock Island, Illinois 61201). *Journal of Applied Physics;* **59**: No. 8, 2747-2751(15 Apr 1986). Contract W-31-109-ENG-38.

Krypton ions with energy 600 keV were implanted in nickel to fluences of 2 x 10^{16} cm^{-2} under three different conditions. Deuterium was subsequently introduced into the implanted regions by electrolysis at room temperature. After the diffusible deuterium was permitted to escape, the $^2H(^3He,^1H)^4He$ nuclear reaction was used to analyze for the trapped deuterium during an isochronal annealing program. The region implanted at 100°C with no higher temperature anneal had the largest number of traps; the region implanted at 100°C and annealed for 100 min at 500°C had considerably less; the region implanted at 500°C had the least. Electron diffraction patterns confirmed the existence of solid crystalline krypton in all three regions. Transmission electron microscope studies revealed precipitates with an average diameter of 8 nm in the region implanted at 500°C. The two regions implanted at 100°C contained smaller precipitates. Trap binding enthalpies were obtained by math modeling. In addition to the traps with binding enthalpy of 0.55 eV reported earlier by other investigators for helium implanted in nickel, a smaller number of traps with binding enthalpies up to 0.83 eV were also found. The trapping of deuterium by various types of imperfections, including the solid krypton precipitates, is discussed.

25866 Anisotropy of transverse sound in the heavy fermion superconductor UPt_3. Shivaram, B.S.; Jeong, Y.H.; Rosenbaum, T.F.; Hinks, D.G. (The James Franck Institute and the Department of Physics, The University of Chicago, Chicago, Illinois 60637). *Physical Review Letters;* **56**: No. 10, 1078-1081(10 Mar 1986). Contract W-31-109-ENG-38.

We report the first measurements of the attenuation of ultrasound in the basal plane of superconducting UPt_3. Transverse sound propagating along the b axis shows a marked anisotropy in its temperature dependence when the polarization is rotated in and out of the basal plane. For polarization in the basal plane the attenuation varies linearly with temperature down to 35 mK and the slope scales as the square of the frequency. Our results appear to indicate the presence of an additional attenuation mechanism when compared with recent theories of anisotropic superconductors in the dirty limit.

25867 First-principles calculation of surface phonons on the Al(110) surface. Ho, K.M.; Bohnen, K.P. (Ames Laboratory-United States Department of Energy; Department of Physics, Iowa State University, Ames, Iowa 50011). *Physical Review Letters;* **56**: No. 9, 934-937(3 Mar 1986). Contract W-7405-ENG-82.

The surface-phonon dispersion curves of Al(110) have been calculated with force constants determined from first-principles self-consistent total-energy calculations. Relaxation of the surface layers produces changes in the surface force constants which have a significant influence on the surface-phonon frequencies near the zone boundary.

25868 Formation of submicron oxide widths on aluminum in the presence of keV electron beams and CO_2 or N_2O. Pitts, J.R.; Massopust, T.P.; Czanderna, A.W.; Kazmerski, L.L. (Solar Energy Research Institute, Golden, Colorado 80401). *Journal of Vacuum Science and Technology, A: Vacuum, Surfaces, and Films;* **4**: No. 2, 241-243(Mar 1986).

The purpose of this paper is to report the size of oxide islands or line widths that can be grown as smaller diameter electron beams are used for the oxidation. The implications of the potential lateral resolution available between oxide lines for electronic materials are discussed. The localize dioxide growth on thin Al films occurs in the presence of .5 to 10 keV electron beams and high vacuum level pressures of carbon dioxide or nitrous oxide. Auger electron spectroscopy shows saturation of the O (KLL) signal and depletion of the Al (LMM) signal after an exposure of 5000 l carbon dioxide with a 2 keV beam of 7 A/sq. cm. The oxide is spatially restricted to the beam impact region and is stable for long periods of time in vacuum. The most plausible mechanism for this oxide growth is dissociation of the carbon dioxide or the nitrous oxide by the electron beam in the region of impingement on or near the surface. Oxygen atoms thus formed can then react with the Al, and carbon monoxide or nitrogen desorbs.

25869 Method for machining steel with diamond tools. Casstevens, J.M. (to Dept. of Energy). US Patent 4,563,114. 7 Jan 1986. Filed date 25 Apr 1983. vp.

This patent describes a method for decreasing the wear rate of a diamond cutting tool used in machining a steel workpiece. This method consists of providing a gaseous hydrocarbon atmosphere at the interface between the cutting tool and the workpiece during the machining of the latter with the concentration of gaseous hydrocarbons being adequate to inhibit the conversion of diamond carbon to graphite carbon at the point of contact of the diamond tool with the workpiece.

25870 Effect of fast neutron irradiation upon the fatigue-crack propagation behavior of Alloy 718 plate and weldments. James, L.A. (Hanford Engineering Development Lab., Richland, WA, USA). *Journal of Nuclear Materials;* **136**: No. 1, 91-96(Oct 1985).

The fatigue-crack propagation (FCP) behavior of Alloy 718 plate and gas-tungsten-arc weldments was studied at 427°C for specimens irradiated up to a total neutron fluence of 7.6×10^{22} n/cm² (28 dpa). Two different precipitation heat-treatments were utilized: a "conventional" treatment and a "modified" treatment. No significant effect of neutron irradiation upon the FCP behavior was noted for any of the material/heat-treatment combinations, except for the conventionally-treated weldments where FCP rates were higher after irradiation. (orig.).

25871 Glassy metal/alloy coatings: Status. Varma, R. (Argonne National Lab., Argonne, IL). pp 940-941 of Proceedings of the spring 1985 meeting of the Electrochemical Society. Pennington, NJ; Electrochemical Society (1985). (CONF-850542—).

From 167. Electrochemical Society meeting; Toronto, Ontario, Canada (12 May 1985).

Glassy metals may be coated onto steel or aluminum to protect against corrosion and wear. This protection may be explained by existing models of glassy metals. Electrodeposition at high current densities and electroless plating of glassy metal/alloy films from suitable electrolytes (as well as sputter- and ion-beam-enhanced deposition in vapor phase) are discussed. The corrosion and wear protection potential of such coatings are then examined.

25872 Electrochemical deposition of glassy chromium on copper. Varma, A.; McKiernan, A.; Klugh, M.J. (Argonne National Lab., Argonne, IL). pp 943 of Proceedings of the spring 1985 meeting of the Electrochemical Society. Pennington, NJ; Electrochemical Society (1985). (CONF-850542—).

From 167. Electrochemical Society meeting; Toronto, Ontario, Canada (12 May 1985).

Electrochemical deposition of chromium at 1.0-5.0 A/cm² current densities from aqueous electrolytes has been investigated. Results of x-ray diffraction and scanning electron microscopy of the film deposits are presented. Also, measurements of the corrosion of such coatings in a saline environment are discussed.

25873 Considerations in estimating corrosion of metallic containers in nuclear waste repositories. Griess, J.C. (Metals and Ceramics Division, Oak Ridge National Laboratory, Oak Ridge, TN). pp 599-602 of Waste isolation in the US, technical programs and public education. Vol. 1. La Grange Park, IL; American Nuclear Society (1984). (CONF-840307—).

From Waste management '84; Tucson, AZ, USA (11 Mar 1984).

Metallic containers for high-level nuclear waste are expected to isolate waste from the repository environment for at least 1000 years. Forms of corrosive attack that could lead to premature failure of the containers and some of the difficulties in predicting corrosion behavior in repositories over long periods of time are discussed.

25874 Environmentally assisted fracture of cast and wrought mild steels in brine. Pitman, S.G.; Hall, E.E. (Pacific Northwest Laboratory, Richland, Washington WA). pp 613-618 of Waste isolation in the US, technical programs and public education. Vol. 1. La Grange Park, IL; American Nuclear Society (1984). (CONF-840307—).

From Waste management '84; Tucson, AZ, USA (11 Mar 1984).

Two test methods, slow strain rate (SSR) tests and corrosion fatigue tests, are being used to investigate the susceptibility of wrought and cast mild steels to environmentally assisted fracture. The SSR test provides an assessment of relative cracking susceptibility, and is most useful for comparing the effects of different environments on a given material, and for measuring the relative susceptibility of different materials to environmentally assisted cracking in a given environment. The corrosion fatigue test measures the stress intensity (which is proportional to stress times the square root of crack length) below which an existing flaw or crack will not grow. The test may also prove useful in measuring the stress intensity that provides an acceptable rate of crack growth. The SSR test has been used to investigate the effects of strain rate, temperature, and solution oxygen content on fracture properties of mild steel. The results of currently available corrosion fatigue tests are limited to crack growth rate measurements at one frequency in air and in brine. These measurements will be part of an overall program to evaluate allowable stress intensities, but this evaluation cannot be made until measurements are taken at different frequencies and at

lower stress intensities. This report, then discusses the background of SSR testing, experimental procedures, results, and conclusions.

25875 **Corrosion of proposed canister materials in salt repositories.** Diegle, R.B.; Glass, R.S.; Sorensen, N.R. (Sandia National Laboratories, Albuquerque, NM). pp 607-612 of Waste isolation in the US, technical programs and public education. Vol. 1. La Grange Park, IL; American Nuclear Society (1984). (CONF-840307—).

From Waste management '84; Tucson, AZ, USA (11 Mar 1984).

Research at Sandia is focussing on Ti-Code-12 (Ti-0.3Mo-0.8Ni) as a corrosion resistant alloy for fabricating canister overpacks, and possibly the canisters themselves. Tests involving the straining of this alloy at applied anodic overpotentials in brine showed that it does not stress corrode. If hydrogen is introduced, either by cathodic polarization in brine or by electrochemically charging prior to testing, embrittlement can occur. Results from gas-charged specimens indicate that noticeable embrittlement occurs at hydrogen concentration above about 400 wppm. Pitting was not observed after experiments involving exposure of coupons for several weeks to neutral brine at temperatures up to 200°C. It did occur during two tests involving brine previously acidified to pH 2, and then only under adherent salt deposits that developed during the tests. These conditions of low pH and adherent salt layer represent an overtest, and pitting is not anticipated in a salt repository. The effects of Ni and Mo alloy additions on the electrochemistry of corrosion of Ti-Code-12 were characterized. The uniform corrosion rates of Ni, Fe, and Ti-based alloys that are being considered as alternate, or backup materials to Ti-Code-12, were measured in brine. No localized corrosion occurred, and the rates of uniform attack of the Ni and other Ti-base alloys were sufficiently low to qualify them analternate alloys to Ti-Code-12. The corrosion rate of cast iron in deaerated brine was 0.13 mm/yr, indicating that cast iron is a corrosion allowance material for potential use in canisters.

25876 **Nuclear waste package design for the vadose zone in tuff.** O'Neal, W.C.; Ballou, L.B.; Gregg, D.W.; Russell, E.W. (Lawrence Livermore National Laboratory, Livermore, CA). pp 547-552 of Waste isolation in the US, technical programs and public education. Vol. 1. La Grange Park, IL; American Nuclear Society (1984). (CONF-840307—).

From Waste management '84; Tucson, AZ, USA (11 Mar 1984).

This report presents an overview of the selection and analysis of conceptual waste package designs that will be used by the Nevada Nuclear Waste Storage Investigations (NNWSI) project for disposal of high-level nuclear waste (HLW) at the proposed Yucca Mountain, Nevada site. The design requirements that the waste packages are required to meet are listed. Concept drawings for the reference designs and one alternative package design are shown. Four metal alloys; 304L SS, 321 SS, 316L SS, and Incoloy 825 have been selected for candidate canister/overpack materials, and 1020 carbon steel has been selected as the reference metal for the borehole liners. A summary of the results of technical and economic analysis supporting the selection of the conceptual waste package designs is included. Post-closure containment and release rates are not discussed in this paper.

25877 **Relativistic effects in solids.** Koelling, D.D.; MacDonald, A.H. (Argonne National Lab., Argonne, IL). pp 227-304 of Relativistic effects in atoms, molecules, and solids. Malli, G.L. New York, NY; Plenum Press (1983). (CONF-8108115—).

From NATO advanced study institute on relativistic effects in atoms; Vancouver, Canada (16 Aug 1981).

This chapter focuses on the relativistic effects occurring in metals and predominantly in transition metals. Uses simplified views of the APW and LCAO methods as examples. Considers the approximations to the kinematics briefly but more carefully examines the inclusion of the relativistic interaction terms. Proposes a simple view of the relativistic effects in solids as being basically the same as those known in atomic structure but modified by the differing boundary conditions. Considers atomic calculations for gold as a prelude to the discussion of the effects in solids. Illustrates the widely known relativistic core contraction by comparing the density obtained from a relativistic and a non-relativistic calculation. Discusses the relativistic APW and KKR technique; the atomic sphere approximation; and approximately relativistic techniques in the appendices.

3602 Ceramics, Cermets, And Refractories

REFER ALSO TO CITATION(S) 25274, 25851, 26450, 26450

25878 **(CBPF-NF—055/85) Low temperature contributions to β-uranium hydride specific heat.** Fernandes, J.C.; Continentino, M.A.; Guimaraes, A.P. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1985. 21p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701495.

Recent observation of Proton Magnetic Resonance in ferromagnetic β-Uranium Hydride by Barash et al. led us to perform a new analysis of the specific heat data of Flotow and Osborne for this compound. In the temperature region 1.469K < = T < = 3.927 K, the specific heat C was found to be given by the expression C = 29.504 T + 0.099 T^3 mJ K^{-1} mol^{-1} while, for 4.332 K < = t < = 15.184 K, C = 28.464 T + 0.157 T^3 + 55.906 [T sup(3/2) + 4/5 T_0 T sup(1/2) + 4/15 T_0^2 T sup(-1/2)]. exp(-T_0/T) in the same units, with T_0 = 79.3 K. This result indicates that the dispersion relation for magnons in this compound has the form E=K sub(B) T_0+DK^2. The large energy gap (K sub(B) T_0) is attributed to the high magneto-crystalline anisotropy arising from the unquenched orbital moment of the uranium ions. To our knowledge this is the first energy gap reported for magnons in an actinide compound.

25879 **(DOE/MC/16454—T13) High temperature-high pressure disposable ceramic probe design.** Grumski, J.T.; Bajura, R.A.; Lutz, S.A. (West Virginia Univ., Morgantown (USA). Dept. of Mechanical and Aerospace Engineering). Aug 1983. Contract AT21-81MC16454. 64p. NTIS PC A04/MF A01. File Number DE84001860.

Pressure drop characteristics were determined for nine probes with various weight loadings of glass bead particles. Even for loadings as high as 1 gram, the pressure loss through the probe did not exceed 0.3 psi for conditions where the inlet velocity was 30 ft/sec. The probes were also weighed and their physical dimensions measured so that a statistical profile of the probe characteristics could be determined. The information will be used in designing a probe holder which could accommodate probes with physical dimensions different from the nominal design specifications. The probes meet the initial design specifications developed jointly by WVU and METC. It is recommended that the probes be field tested in high temperature-high pressure sampling applications to determine their overall usefulness for severe service conditions.

25880 **(LA—10617-MS) Flexure strength analysis of Los Alamos ceramic bodies Al-13, Al-18, and MgO-Y_2O_3.** Enloe, J.H.; Gac, F.D.; Trujillo, E.J. (Los Alamos National Lab., NM (USA)). Feb 1986. Contract W-7405-ENG-36. 29p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86008576.

Flexure strength was determined by four-point loading and analyzed using Weibull analysis for selected Los Alamos National Laboratory ceramic materials including an MgO-3 wt % Y_2O_3 body and alumina bodies AL-13 and AL-18. Fractographic and microstructural characterizations were also performed on the materials. Results of the Weibull analysis conclude that AL-13 has exceptionally high strength reliability, whereas AL-18 and MgO-3 wt% Y_2O_3 have strength reliabilities comparable to most ceramic materials. Strength data were also compared to data for similar materials from commercial literature.

25881 **(SAND—85-2076C) Raman scattering analysis of thin-film coatings using guided waves.** Stewart, A.F.; Tallant, D.R.; Higgins, K.L. (Sandia National Labs., Albuquerque, NM (USA); Air Force Weapons Lab., Kirtland AFB, NM (USA)). 1985. Contract AC04-76DP00789. 20p. (CONF-851052—5). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86008776.

From 17. annual symposium on optical materials for high-power lasers; Boulder, CO, USA (28 Oct 1985).

Selected refractory-oxide, thin-film coatings have been analyzed using Raman spectroscopy. Diamond and rutile prisms were used to couple the probe beam into the thin-film coatings which served as waveguides. Propagation of the probe beam as a guided wave in the thin film increases the probability for Raman scattering by species in the thin film compared to techniques which depend on a single pass through or probe beam reflection at the film. Because the probe beam is confined entirely within the thin-film coating, Raman spectra are obtained which are generally free of vibrational bands due to the substrate. The combination of more efficient coupling between the probe beam and the thin film and the elimination of substrate interferences results in improved sensitivity and the ability to record recognizable Raman spectra of thin films composed even of materials that are relatively inefficient Raman scatterers.

25882 **(UCRL—93493) Fusion neutron irradiation of NiSi alloys at 4.2K.** Guinan, M.W.; Huang, J.S.; Hahn, P.A. (Lawrence Livermore National Lab., CA (USA)). 18 Mar 1986. Contract W-7405-ENG-48. 17p. (CONF-860421—11). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86008769.

From 2. international conference on fusion reactor materials (ICFRM-2); Chicago, IL, USA (13 Apr 1986).

Two Ni alloys with 4 at.% Si and 12.7 at.% Si in solution have been irradiated at 4.2K with 14 MeV fusion neutrons. The resistivity damage rate of well annealed Ni-4%Si alloy showed an initial transient in the plot of dΔrho/dΔphit versus Δrho. A high dislocation density appeared to reduce this transient. The resistivity damage rate of Ni-12.7%Si alloy showed an unusual behavior; dΔrho/dΔphit increases with Δrho after the initial transient period. This behavior is attributed to precipitation and growth of Ni_3Si during irradiation. Post-irradiation isochronal annealing results showed significant effects of cold work and composition on recovery. Ni-4%Si recovered slower than pure nickel and a high dislocation density enhanced its recovery. For the Ni-12.7% Si alloy, recovery ended after being annealed to 38K, after which the resistivity increased with annealing temperature. This is attributed to further precipitation and growth of Ni_3Si.

25883 **(VTT-TIED—481) Joining of ceramics for high temperature applications.** Vilpas, M. (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)). Aug 1985. 37p. (In Finnish). NTIS (US Sales Only), PC A03/MF A01. File Number DE86751572.

The report is a summary of literature survey to the methods for joining ceramics to ceramics or ceramics to metals for high temperature applications. Also mechanical properties and potential applications of the joints are considered. The joining of ceramics is usually carried out by brazing or diffusion bonding. Especially the letter has been found useful and increased the applications of joined ceramics. Recently also the possibilities to use electron beam and laser beam welding for joining of ceramics have been investigated. The joining of ceramics has found numerous applications, typical for high operating temperatures being different sensors and thremocouples.

3603 Composite Materials

REFER ALSO TO CITATION(S) 25510, 25998

25884 **(BNL—36465-Rev.) Furfuryl alcohol polymer concretes for use in all-weather repairs of concrete and asphalt surfaces. Revision.** Kukacka, L.E.; Sugama, T. (Brookhaven National Lab., Upton, NY (USA)). Apr 1985. Contract AC02-76CH00016. 22p. (CONF-8510115—1-Rev.). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86008392.

From American Concrete Institute fall meeting on polymers in concrete; Chicago, IL, USA (3 Oct 1985).

A furfuryl alcohol-based polymer concrete (FA-PC) has been developed for use as an all-weather repair material for concrete and asphalt surfaces. A formulation consisting of furfuryl alcohol monomer (FA), α, α, α-trichlorotoluene, pyridine, silane, zinc chloride, silica filler, and coarse aggregate meets requirements. Optimized formulations were established for use with premixed and percolation placement methods. The working time for the FA-PC slurry can be controlled at ≧ 15 min from -20°C to 52°C by simply varying the α, α, α-trichlorotoluene catalyst concentration while holding all of the other constituents constant. Below -20°C, slight increases in FA and $ZnCl_2$ concentrations are needed to yield optimum properties. Prototype equipment for the mixing and placement of FA-PC was constructed and used in a series of tests up to a size of 6-m x 6-m x 0.15-m. Field tests were performed under rainfall and dry conditions from -15° to 35°C. The mixing and placement equipment performed well and the FA-PC slurries exhibited self-leveling characteristics. Test results from proxy samples and cores taken after simulated aircraft trafficking, indicated that the property requirements at an age of 1 h were attained.

25885 **(CONF-860152—2) Improved fiber-reinforced SiC composites fabricated by chemical vapor infiltration.** Stinton, D.P.; Caputo, A.J.; Lowden, R.A.; Besmann, T.M. (Oak Ridge National Lab., TN (USA)). 1986. Contract AC05-84OR21400. 13p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86008539.

From 10. annual conference on composites and advanced ceramic materials; Cocoa Beach, FL, USA (19 Jan 1986).

Fabrication of fiber-reinforced composites by a patented chemical vapor infiltration process has continued. Modifications to the process used for infiltration of unidirectional preforms resulted in more uniform matrix deposition throughout the preform and improved mechanical properties of the composites. Infiltration of improved cloth preforms containing more uniform porosity resulted in composites with fewer and smaller voids.

3604 Polymers And Plastics

REFER ALSO TO CITATION(S) 25510, 25836, 26022

3606 Other Materials

REFER ALSO TO CITATION(S) 25800, 25967, 26144

25886 **(AD-A—162326/3/XAB) Structure-property relationships in intercalated graphite. Semi-annual report, 1 October 1984-31 March 1985.** Dresselhaus, M.S. (Massachusetts Inst. of Tech., Cambridge (USA)). 10 Jul 1985. 22p. NTIS, PC A02/MF A01.

Experimental and theoretical studies were carried out relevant to the structural, lattice electronic, magnetic, and superconducting properties of synthetic metals prepared by intercalating graphite. New synthesis methods were developed for preparing magnetic-transition metal chloride and potassium-hydrogen graphite intercalation compounds. The use of ion implantation to enhance intercalation were explored, and promising results were obtained. Structural studies using high-resolution x-ray scattering and transmission electron microscopy were applied to study two-dimensional structural phase transitions such as the commensurate to incommensurate stripe phase transition in bromine intercalated graphite and commensurate to glass-phase transition in antimony pentachloride intercalated graphite. The construction of a Raman microprobe allows study of the spatial homogeneity (to 2-micron resolution) of the staging in specific intercalated graphite samples. The high-field magnetoresistance anomaly in graphite identified with a charge-density wave has been further explored with particular emphasis given to the role of impurities in pair-breaking phenomena and pulsed electric fields in nonlinear non-ohmic effects. The theoretical model developed to explain the superconducting behavior in the first stage alkali metal compounds has guided studies on superconducting graphite intercalation compounds with higher transition temperatures with particular relevance to their superconducting behavior and their related Fermi surface and phonon-mode properties.

25887 **(AD-A—162373/5/XAB) Superlattice effects in graphite intercalation compounds. Annual report, 1 October 1984-30 September 1985.** Markiewicz, R.S. (Northwestern Univ., Evanston, IL (USA). Dept. of Physics). 22 Oct 1985. 30p. NTIS, PC A03/MF A01.

A new kind of two-dimensional, field-induced phase transition was discovered in Br_2 graphite intercalation compounds. Similar to, but much more pronounced than Condon domain formation in three-dimensions, it is a Landau-level instability that results in two types of domains having different numbers of Landau levels occupied. The domains display a striking nonlinear dynamics in an a.c. magnetic field, with phenomena including resonance, hysteresis, and a quasiperiodic route to chaos. A theoretical basis for analyzing the data was developed, and the high-frequency resonance appears to be a transverse vibration of the domain array, similar to that predicted for the superconducting intermediate state.

25888 **(AD-A—162807/2/XAB) Thin film synthesis of superconducting chemical compounds. Final report, 1 January 1984-14 October 1985.** Sienko, M.J. (Cornell Univ., Ithaca, NY (USA). Baker Lab.). 11 Nov 1985. 12p. NTIS, PC A02/MF A01.

The effect on crystallographic parameters of selenium for sulfur replacement has been studied in several series of ternary molybdenum chalcogenides of the Chevrel-Phase type. The magnetic and superconducting properties of these ternaries was investigated.

25889 **(AD-A—163047/4/XAB) Development and application of sims (secondary ion mass spectrometry) characterization techniques for the study of impurities and impurity motion in (HgCd)Te and CdTe. Final report, 1 November 1983-30 September 1985.** Evans, C.A. (Evans (Charles) and Associates, San Mateo, CA (USA)). 30 Sep 1985. 77p. NTIS, PC A05/MF A01.

The tasks in the Statement of Work for this Contract were: Develop quantitative methods of secondary ion mass spectrometry (SIMS) analysis; and Study the incorporation and redistribution of impurities in (HgCd)Te and CdTe. The second task included investigation of MeV-ion implantation into (HgCd)Te and development of image-processing techniques for potentially quantitative investigation of laterally distributed impurities. The mechanisms and protocols developed were applied to various kinds of (HgCd)Te and it homologs in the characterization of a variety of dopants and impurities of interest to DARPA and its subcontractors. These applications elucidated the mechanism of boron incorporation during the LEC growth of CdTe.

25890 **(ANL—85-62) Reaction of glass during gamma irradiation in a saturated tuff environment. Part 1. SRL 165 glass.** Bates, J.K.; Fischer, D.F.; Gerding, T.J. (Argonne National Lab., IL (USA)). Feb 1986. Contract W-31-109-ENG-38. 88p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE86008792.

The influence of gamma irradiation on the reaction of actinide-doped borosilicate glass (SRL 165) in a saturated tuff environment has been studied in a series of tests lasting up to 56 days. The following conclusions were reached. The reaction of, and subsequent actinide release from, the glass depends on the dynamic interaction between radiolysis effects, which cause the solution pH to become more acidic; glass reaction, which drives the pH more basic; and test component interactions that may extract glass components from solution. The use of large gamma irradiation dose rates to accelerate reactions that may occur in an actual repository radiation field may affect this dynamic balance by unduly influencing the mechanism of the glass-water reaction. Comparisons between the present results and data obtained by reacting similar glasses using MCC-1 and NNWSI rock cup procedures indicate that the irradiation conditions used in the present experiments do not dramatically influence the reaction rate of the glass. 8 figs., 9 tabs.

25891 **(CBPF-MO—001/85) Local order and magnetism of amorphous and disordered solids. Studies by Moessbauer effect, EXAFS, static and dynamical susceptibilities.** Friedt, J.M. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1985. 33p. (In French). NTIS (US Sales Only), PC A03/MF A01. File Number DE86701486.

Some topics related with the magnetic properties and local order in amorphous and disordered solids studied by Moessbauer spectroscopy, EXAFS, static and dynamical susceptibilities are presented.

25892 **(CBPF-NF—030/85) Effect of the H_2O/TEOS ratio on the structure of gels derived by the acid catalysed hydrolysis of tetraethoxysilane.** Strawbridge, I.; James, P.F.; Craievich, A.F. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1985. 38p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86701490.

Silica gels were produced by the acid catalysed hydrolysis of tetraethoxysilane (TEOS) using H_2O/TEOS ratios from 2 to 50. After heat treatment, the structure of the gels was studied using nitrogen adsorption, small angle X-ray scattering (SAXS), transmission electron microscopy (TEM) and bulk density measurements. All the gels possessed microporosity in the region of 30 A or less. For H_2O/TEOS = 25 and 50, the matrix density was found to be uniform, but for gels from solutions with H_2O/TEOS = 2, 4 and 10, density fluctuations in the matrix were detected from a Porod analysis of the SAXS data. These results indicate that in high water content solutions, rearrangement of the polymeric chains leads to small densified particles, but for lower water content solutions, gelation results from the entanglement of linear chains leaving free volume on a molecular scale between the chains.

25893 **(CBPF-NF—046/85) Study by Moessbauer spectroscopy of the iron-dextran (Imferon).** Araujo, S.I. de; Danon, J. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1985. 19p. (In Portuguese). NTIS (US Sales Only), PC A02/MF A01. File Number DE86701493.

The iron-dextran complexes (Imferon) are very important in the anemia treatment resulting of the iron insufficiency. Recent studies by electron diffraction denoted that the Imferon is structurally different of the ferritin, one protein which constitute the iron reserve substance in the organisms. However, the obtained data in the Imferon by Moessbauer spectroscopy, in different temperature ranges (room, liquid nitrogen and liquid He), show a great resemblance between this compound and the ferritin. A Fe^{3+} distorted octahedrical coordination is observed in both compounds, agreeing with measurements done in ferritin by EXAFS. In spite of the concordant results, nevertheless, some discrepancies persist. The ferritin seems to be a rather more ionic than the Imferon, possibly due to the rather higher interatomic distance in the former compound. In these measurements, a field of 484,6 + - 5 KOe is found for the Imferon which, compared with the field of 493 + - 10 KOe for ferritin, confirms to be the ferritin more ionic than the Imferon. It is, however, a little difference when it is compared to the existent between the iron binary oxides β FeOOH and γFeOOH.

25894 **(CONF-860418—2) Testing protocols for evaluating monolithic waste forms containing mixed wastes.** Gilliam, T.M.; Sams, T.L.; Pitt, W.W. (Oak Ridge National Lab., TN (USA)). 1986. Contract AC05-84OR21400. 11p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86008498.

From 88. annual meeting of the American Ceramic Society; Chicago, IL, USA (27 Apr 1986).

Test protocols have been presented which can be used as a guide in cement-based grout formulation development studies. Based on experience at ORNL, these six tests are generally sufficient to develop a grout product which will meet all applicable DOE, NRC, and EPA performance criteria. As such, these tests can be used to minimize the time required to tailor a grout to be compatible with both the waste stream and the process disposal scenario. 9 refs.

25895 **(CONF-860585—1) Two-surface plastic model for concrete and geomaterials.** Chern, J.C.; Lin, F.B.; Marchertas, A.H. (Argonne National Lab., IL (USA); National Taiwan Univ., Taipei; Northwestern Univ., Evanston, IL (USA)). 1986. Contract W-31-109-ENG-38. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86007475.

From International conference on computational mechanics; Tokyo, Japan (25 May 1986).

A constitutive model based on the elastic-plastic formulation coupled with the critical state theory used in soils is presented. A conventional elastic-plastic model is applied to represent the structural behavior up to the maximum strength capacity of material. Beyond this point, the modified critical state theory is used to simulate the material response. In this way, the softening (or hardening)

of the material can be accounted for. The softening (or hardening) of the material is facilitated by the shrinkage (or expansion) of a limiting surface in the stress space. This surface is assumed to coincide with the failure surface at the maximum strength of material. It is derived with the help of the five-parameter Willam-Warnke failure surface. The shape of the limiting surface has the same angular dependence as the failure surface of the deviatoric plane. In the meridian plane, the shape is assumed to be that of a slanted ellipse. The described constitutive model is very simple, requiring a minimum of experimental data for input. It is applicable to concrete, geomaterials, and other materials which have different strengths in tension and compression.

25896 **(DP-MS—85-158) Leaching of saltstones containing fly ash.** Barnes, M.W.; Roy, D.M.; Langton, C.A. (Pennsylvania State Univ., University Park (USA). Materials Research Lab.; Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1985. Contract AC09-76SR00001. 12p. (CONF-851217—59). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86008046.

From Materials Research Society meeting; Boston, MA, USA (2 Dec 1985).

Two types of fly ash were incorporated in saltstones designed for potential encapsulation of Savannah River Plant low level defense waste. These fly ashes have some cementitious properties while at the same time their presence in substitution for cement slows early hydration. Class C fly ash has a high calcium content and is considered cementitious; Class F fly ash has a low calcium content and is not classified as cementitious. Leach tests were performed and physical properties were measured for saltstones containing each class, to see the differences in the effect of the fly ashes. The four waste ions nitrate, nitrite, sodium and sulfate were shown to leach by diffusion. Effective diffusivities were determined for these ions. Data for nitrate, the most important species from the environmental point of view, are shown in Table A. Saltstones made with Class C fly ash have substantially lower leach rates than those made with Class F fly ash. The leach rates, and therefore the square roots of the effective diffusivities, have been found to be proportional to the pore surface area per unit volume (or the ratio of pore volume to pore radius), to the fraction of waste containing solution, and to the inverse of the fraction of calcium in the saltstone. Rates and diffusivities are not proportional to the water to cement ratio, because this number depends on whether the fly ash is counted as cementitious, as in Class C cement, or not cementitious, as in Class F cement. In fact the relatively small amount of calcium in Class F cement contributes to the cementitious properties overall, though not so much as Class C cement. 4 refs., 2 figs., 6 tabs.

25897 **(K/PS—1128) Thermal properties evaluation of UF_6 cylinder overpack insulation.** Frazier, J.L. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 29 Nov 1985. Contract AC05-84OT21400. 23p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86008688.

A phenolic foam is incorporated into the design and construction of UF_6 cylinder shipping containers known as overpacks. The overpack provides mechanical and thermal protection to UF_6 product cylinders during transport. The phenolic foam is utilized for thermal insulation. An important criterion in overpack design is to limit temperature excursions of the product cylinder below the triple point of UF_6, preventing possible overpressurization of the cylinder. A current requirement is that the product cylinder wall temperature be maintained below the UF_6 triple point with the outer surfaces of the overpack exposed to 1475°F for thirty minutes. A possible heat source is the close proximity of a fire. Overpack thermal protection design requires thermal properties data for the materials of construction, particularly for the phenolic foam insulation which provides the primary thermal resistance. Thermal conductivity and heat capacity data for the phenolic foam are limited in the literature. Accurate heat transfer models of the overpack require thermal properties spanning the range from room temperature to 1475°F. An experimental program was devised to measure the thermal conductivity and heat capacity of the insulating foam over the temperature span of interest.

25898 **(PB—86-144102/XAB) Report on artificially structured materials. Final report.** (National Research Council, Washington, DC (USA)). 1985. 136p. NTIS, PC A07/MF A01.

Advances in high-vacuum and semiconductor growth techniques have made it possible to tailor-make materials one atomic layer at a time. In this way materials not occuring in nature, with particular electrical, magnetic, optical, or mechanical properties ultimately may be designed and fabricated. This report describes the types of materials used, concentrating on GaAs and GaAlAs compounds; the structures involved, such as superlattices and heterostructures; the scientific opportunities in, for example, superconductor and semiconductor technologies; and the applications possible with ASMs. The report discusses the various fabrication, diagnostic, and characterization methods used in the production of ASMs. Finally, the report lists some of the difficulties confronting researchers, such as the need for easily-available, high-purity samples, and state-of-the-art equipment to fabricate ASMs. The report makes recommendations for federal funding support to allow the US to maintain the lead in this field.

25899 **(VTT-TUTK—305) Arctic concrete technology.** (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)). Sep 1984. 152p. (In Finnish). NTIS (US Sales Only), PC A08/MF A01. File Number DE86751573.

Properties of concrete were studied in three test series, which all included concretes with and without air-entrainment and with hollow plastic microspheres. Frost resistance was studied in freeze-thaw tests in the temperature range of +20 to -65 deg C. The concretes with air-entrainment underwent their tests well while the concretes without air-entrainmnet and the concretes with microspheres lost their strength much faster than in normal tests at the temperature of +20 to -20 deg C. Freezing strength was checked using the freezing temperature of -65 deg C and it was found out that the value given in the Finnish Concrete Standards, 5 MPa, is also then safe. Compressive strength and elastic modulus were tested with different moisture contents at +20, -20 and -70 deg C. The moister the concrete was, the more the compressive strength increased when the temperature decresed. The elastic modulus incresed slower than the compresive strength when the temperature was dropped and in some cases with partly dry concretes it even slightly decreased at -20 deg C.

25900 **High-temperature thermodynamic properties of alpha and gamma lanthanum sesquisulfides and related compounds.** Amano, T.; Beaudry, B.J.; Gschneidner K.A. Jr. (Ames Laboratory and Department of Materials, Science and Engineering, Iowa State University, Ames, Iowa 50011). *Journal of Applied Physics;* 59: No. 10, 3437-3440(15 May 1986). Contract W-7405-ENG-82.

The high-temperature heat contents of $La_2S_3(\alpha)$, $La_2S_3(\gamma)$, La_3S_4, and La/sub 2.65/Eu/sub 0.35/S_4 were measured from 400 to 1800 K by using a copper block drop calorimeter. The heat and entropy of transition of the α-to-γ transformation of La_2S_3 was determined. Equations for the thermodynamic functions H°/sub T/-H°/sub 298.15/, C/sub p/, S°/sub T/-S°/sub 298.15/ and -(F°/sub T/-H°/sub 298.15/)/T were derived in terms of the least-squares fit parameters of the heat content data.

25901 **Effects of macroscopic inhomogeneities on electron mobility in semi-insulating GaAs.** Walukiewicz, W.; Wang, L.; Pawlowicz, L.M.; Lagowski, J.; Gatos, H.C. (Center for Advanced Materials, Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Journal of Applied Physics;* 59: No. 9, 3144-3147(1 May 1986). Contract AC03-76SF00098.

We show that defect inhomogeneities of sizes larger than the electron mean free path are responsible for the low values and anomalous temperature dependence of the electron mobility in semi-insulating (SI) GaAs. The room-temperature electron mobility values below about 6000 cm^2/V s cannot be uniquely used for the determination of the concentration of ionized defects, since the contribution from inhomogeneities usually exceeds that from scattering by ionized impurities. The effects of the macroscopically inhomogeneous distribution of residual acceptors and the major deep donor

EL2 diminish at elevated temperatures between 600 and 900 K, which offers a means for identification of inhomogeneities, and furthermore explains recently reported steplike mobility versus temperature behavior in SI-GaAs.

25902 **Impulse photoconductance of thin-film polycrystalline silicon.** Hammond, R.B.; Johnson, N.M. (Electronics Division, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Journal of Applied Physics;* **59**: No. 9, 3155-3159(1 May 1986).

Using optoelectronic correlation and sampling oscilloscope techniques we measured impulse photoconductance of polycrystalline-Si thin-film photoconductors excited by femtosecond dye-laser pulses. We studied as-deposited micrograin films as well as annealed, H-passivated, and H-passivated/annealed films. Results yielded photoexcited carrier mobilities of 6.8 and 104 cm^2/V s, respectively in as-deposited and 1150 °C-annealed films. The photoconductance decays of as-deposited films showed an initial fast decay time of ~22 ps followed by a primary decay time of ~150 ps. Photoconductance decays of annealed films showed similar primary decay times but no initial fast decay transient. H passivation of both as-deposited and annealed films produced no changes in carrier mobilities. However, H passivation of as-deposited films eliminated the initial fast decay transient and increased the primary decay time to ~800 ps. H passivation of annealed films increased decay time only slightly. Results suggest that grain boundaries control decays in as-deposited films but not in annealed films, and that H passivation does not reduce carrier scattering.

25903 **Si incorporation probabilities and depth distributions in Ga/sub 1-x/Al/sub x/As films grown by molecular-beam epitaxy.** Rockett, A.; Klem, J.; Barnett, S.A.; Greene, J.E.; Morkoc, H. (Department of Metallurgy, The Coordinated Science Laboratory, and The Materials Research Laboratory, University of Illinois, 1101 West Springfield Avenue, Urbana, Illinois 61801). *Journal of Applied Physics;* **59**: No. 8, 2777-2783(15 Apr 1986).

The Si incorporation probability σ/sub Si/ of Si and the segregation-induced broadening Δ/sub s/ of nominally abrupt Si doping modulations during the deposition of Ga/sub 1-x/Al/sub x/As films grown by molecular-beam epitaxy (MBE) have been measured as a function of film growth temperature T/sub s/, alloy composition x and As_2 overpressure. Si depth distributions were obtained using secondary ion mass spectrometry (SIMS) calibrated with internal standards. The inherent broadening due to the SIMS sputter profiling Δ_0 was ~6.5 +- 1 nm. Dopant modulations generated by abrupt changes in the incident Si flux were found to exhibit broadening which varied, after subtracting the instrumental effects, from Δ/sub s/≃7 nm at 600°C to 25 nm at 725°C. Thus, Si segregation during Ga/sub 1-x/Al/sub x/As MBE, while quite small compared to other dopants such as Sn, was still measurable. The fact that Δ/sub s/ increased with increasing T/sub s/ indicates that the segregation rate was kinetically limited over the temperature range investigated in these experiments. There was a slight tendency for an increase in Si segregation with increasing Al content in the film. However, increasing the As_2 overpressure by a factor of 3 above that required to obtain an As-stabilized surface had no measurable effect on Si segregation. A lower limit for the Gibbs free energy of segregation was found to be ~0.4 eV. The Si-incorporation probability σ/sub Si/ in Ga/sub 1-x/Al/sub x/As was unity at T/sub s/< or ≃600°C and decreased to ~0.5 at 725°C.

25904 **Anomalous temperature dependence of lattice parameters of metalorganic chemical vapor deposition CdTe grown on GaAs.** Staudenmann, J.; Horning, R.D.; Knox, R.D.; Arch, D.K.; Schmit, J.L. (Ames Laboratory, USDOE and Department of Physics, Iowa State University, Ames, Iowa 50011). *Applied Physics Letters;* **48**: No. 15, 994-996(14 Apr 1986). Contract W-7405-ENG-82.

It is reported that the lattice parameters of a 3-μm-thick [1,0,0] single crystal CdTe epitaxial layer on a [1,0,0] single crystal GaAs substrate behave anomalously below 120 K. The epilayer used in this experiment was deposited at 410 °C by metalorganic chemical vapor deposition. This x-ray lattice parameter study was done in the temperature range between about 8 and 300 K. Our results show that the lattice parameters perpendicular to the surface of both the GaAs substrate and the CdTe epilayer shrink four times more than the corresponding bulks when the samples are cooled down to 10 K. It is further seen that there is no compensation effect between the elements of the composite system; that is, the lattice parameters of the two materials change in the same direction as if the composite system: the epilayer and the thickness of the substrate which is probed by the x rays: would behave as a new material with entirely new physical properties.

25905 **Proton isolated In/sub 0.2/Ga/sub 0.8/As/GaAs strained-layer superlattice avalanche photodiode.** Bulman, G.E.; Myers, D.R.; Zipperian, T.E.; Dawson, L.R. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Applied Physics Letters;* **48**: No. 15, 1015-1017(14 Apr 1986). Contract AC04-76DP00789.

We have fabricated the first proton isolated strained-layer superlattice (SLS) avalanche photodiode. The grown In/sub 0.2/Ga/sub 0.8/As/GaAs p^+n SLS structure was bombarded outside the active region with 220 keV protons to a total dose of 1 x $10^{15} cm^{-2}$. These first nonoptimized devices exhibit a breakdown voltage of 23.5 V with a dark current density of 1.3 x $10^{-3} A/cm^2$ at 90% of the breakdown voltage. The isolation is stable under annealing for 10 min at 350 °C. Uniform photoresponse is observed across the active region with two order of magnitude reduction in response occurring in the isolation region. A peak uncoated external quantum efficiency of 25% at 910 nm is observed with 10 V reverse bias and photocurrent multiplication is observed at higher bias values. These results demonstrate that proton isolation can be successfully applied to strained-layer systems and can be incorporated in useful device structures.

25906 **Forward bias induced annealing of the E center in silicon.** Barnes, C.E.; Samara, G.A. (Sandia National Laboratories, Albuquerque, New Mexico 87115). *Applied Physics Letters;* **48**: No. 14, 934-936(7 Apr 1986). Contract AC04-76DP00789.

It has been well established that the annealing of the E center (phosphorus vacancy) in Si is charge state dependent with the recovery proceeding more rapidly in the neutral charge state than in the negative state. Herein, we report for the first time a third annealing condition with a strongly enhanced annealing rate for the E center: forward bias induced recovery with a significantly lower activation energy of 0.48 eV.

25907 **Measurements of drop size at the spray edge near the nozzle in atomizing liquid jets.** Wu, K.; Reitz, R.D.; Bracco, F.V. (Mechanical and Aerospace Engineering Department, Princeton University, Princeton, New Jersey 08544). *Physics of Fluids;* **29**: No. 4, 941-951(Apr 1986). Contract AC04-81AL16338.

The drop size distribution was measured from back-lighted spark photographs at the edge of steady sprays in the immediate vicinity of the nozzle exit. The conditions of these liquid-into-gas sprays were such that the outer surface of the liquid jets broke up into small drops at the nozzle exit. The objective was to elucidate the mechanism of breakup. At room temperature, n-hexane and n-tetradecane at pressures from 2.86 to 9.76 MPa were injected into gaseous nitrogen at 1.48 to 2.86 MPa through three straight cylindrical nozzles of different diameters, 127 and 335 μm, and length-to-diameter ratios, 4 and 10. In all cases, the drop sizes could be fitted satisfactorily with a chi-square distribution with degree of freedom equal to 28. The Sauter mean drop diameter and other average diameters were found to decrease with increasing injection velocity and decreasing liquid surface tension, to be insensitive to nozzle diameter and length, and to increase slightly with increasing gas density. The trends and magnitudes are in agreement with those predicted by the supplemented aerodynamic theory of surface breakup if it is assumed that between the jet surface where the drops are formed, that is not visible, and the edge of the spray, where the measurements were made, drops undergo collisions and coalescence. In this region of dense sprays, drop coalescence leads to a rapid increase in drop size, particularly in high gas densities.

25908 Quasiperiodic transitions to chaos of instabilities in an electron-hole plasma excited by ac perturbations at one and at two frequencies. Held, G.A.; Jeffries, C. (Department of Physics, University of California, Berkeley, California 94720 and Materials and Molecular Research Division, Lawrence Berkeley Laboratory, Berkeley, California 94720). *Physical Review Letters;* **56**: No. 11, 1183-1186(17 Mar 1986). Contract AC03-76SF00098.

Periodic instabilities of frequency f_0 in an electron-hole plasma in Ge are excited with an external perturbation $V_1 \sin(2\pi f_1 t)$. Varying V_1 and f_1 results in quasiperiodic, mode-locked, and chaotic states comparable to those expected theoretically. Increasing V_1 while keeping the ratio f_0/f_1 fixed at the golden mean (1.6180 . . .), we observe a universal transition to chaos, in quantitative agreement with theory. Driving the instability simultaneously at two incommensurate frequencies, f_1 and f_2, we observe transitions between three-frequency quasiperiodicity, two-frequency mode locking, and chaos.

25909 Spin-density-wave transitions in a magnetic field. Kwak, J.F.; Schirber, J.E.; Chaikin, P.M.; Williams, J.M.; Wang, H.; Chiang, L.Y. (Sandia National Laboratories, Albuquerque, New Mexico 87185;). *Physical Review Letters;* **56**: No. 9, 972-975(3 Mar 1986). Contract AC04-76DP00789.

We report new Hall measurements on $(TMTSF)_2PF_6$ under pressure. Our data, and a simple model, directly link the novel magnetic-field—induced state first seen in the Bechgaard salts to a well-characterized ambient-pressure spin-density-wave state. Comparison of the data for different salts suggests that (1) incommensurability associated with a two-dimensional lattice in a magnetic field splits the Landau levels into Landau subbands, and (2) coupling to soft modes changes the field-induced spin-density-wave transitions from second order to first order.

25910 Structural studies of hydrogen-bombarded silicon using ellipsometry and transmission electron microscopy. Collins, R.W.; Yacobi, B.G.; Jones, K.M.; Tsuo, Y.S. (Standard Oil Company Research Center, Cleveland, Ohio 44128). *Journal of Vacuum Science and Technology, A: Vacuum, Surfaces, and Films;* **4**: No. 2, 153-158(Mar 1986). Contract AC02-83CH10093.

Hydrogen-bombardment-induced structural changes in single-crystal silicon were studied using ellipsometry and transmission electron microscopy techniques. Hydrogen ion energies ranged from 400 to 1900 eV and the total dose was about 5×10^{19} ions/cm^2. Various degrees of damage and phase mixtures in the layers were identified. It was concluded that ellipsometry can be used effectively as a nondestructive characterizational tool for analyzing bombardment-induced microstructural changes in this material.

25911 Preparation and characterization of Si/sub x/Se/sub 1-x/ glasses and determination of the equilibrium phase diagram. Johnson, R.W.; Susman, S.; McMillan, J.; Volin, K.J. (Mat. Sci. and Tech. Div., Argonne National Lab., Argonne, IL 60439). *Materials Research Bulletin;* **21**: No. 1, vp(Jan 1986).

Glasses in the Si/sub x/Se/sub 1-x/ $0.0 < x < 0.40$ alloy system have been prepared and characterized by bulk glass density and glass transition temperature measurements. Systematic changes in molar volume vs. concentration indicate the onset of major structural changes at $x \approx 0.22$ and $x = 0.33$. The first determination of the equilibrium phase diagram for the Se-rich region of the Si-Se alloy system is presented.

25912 Transient photoconductivity in insulators at very high photocarrier concentrations. Hughes, R.C.; Sokel, R. (Sandia National Labs, Albuquerque, NM). pp 593-604 of Physics of disordered materials. New York, NY; Plenum Press (1985).

Transient photoconductivity has been widely exploited as a tool for determining transport properties of electrons and holes in both insulators and semiconductors. It is now well known that SiO_2 is unique among the wide band gap amorphous insulators in that the excess electrons maintain the high mobility expected in the single crystal, while the holes are localized on a very short time scale and have mobilities at least six orders of magnitude lower than electrons. In the submicrosecond range the holes will appear almost immobile and very large threshold shifts can occur at radiation doses of a few thousand rads. The MOSFETs are useless in this time regime and the question becomes: how long must you wait for the holes to drift a sufficient distance to bring the threshold shift down to a level where the MOSFET can operate within its circuit parameters? This question has been answered experimentally by measuring the transient photoconductivity and transient threshold shifts (or flatband shifts on MOS capacitors) on a variety of MOS structures. The processing of the gate SiO_2 can have a profound effect on the drift and trapping of the holes and so data must be taken on each different kind of MOS structure; by dirty processing it is possible to make the hole trapping so efficient that the space charge will remain fixed for years at room temperature.

25913 Effects of annealing on the electrical properties of high resistivity polycrystalline silicon. Schubert, W.K. (Sandia National Laboratories, Albuquerque, NM). pp 381 of Proceedings of the spring 1985 meeting of the Electrochemical Society. Pennington, NJ; Electrochemical Society (1985). (CONF-850542—). Contract AC04-76DP00789.

From 167. Electrochemical Society meeting; Toronto, Ontario, Canada (12 May 1985).

The effects of various annealing procedures on the electrical properties of lightly arsenic-implanted polysilicon have been investigated. For short anneals ($\geqq$1h), a reverse annealing peak in the sheet resistance is observed around 900°-1000°C. The peak is at least partially caused by changes in the grain boundary barriers which arise from majority carrier trapping. Contributions to the effect from grain growth and recrystallization, and dopant diffusion are also being investigated.

25914 Fractal structures in random materials. Schaefer, D.W. (Sandia National Lab., Albuquerque, NM). pp 455 of Proceedings of the spring 1985 meeting of the Electrochemical Society. Pennington, NJ; Electrochemical Society (1985). (CONF-850542—).

From 167. Electrochemical Society meeting; Toronto, Ontario, Canada (12 May 1985).

The structure of random materials must, in some way, reflect the random process by which the material is produced. Typical random processes include polymerization, colloid aggregation, and phase separation. All these processes occur in the silica system. In porous silica aerogel, for example, structure of the solid is traced to a colloid aggregation process in the solution precursor. The polymerization of silica is also studied and a variety of random structures is observed, depending on the chemical growth conditions.

25915 The detection and analysis of the breakdown of oxide films on aluminum in chloride-dichromate solutions. Hawkins, J.; Thompson, G.E.; Wood, G.C.; Isaacs, H.S. (Corrosion and Protection Center, University of Manchester, Institute of Science and Technology, Manchester). pp 60 of Proceedings of the spring 1985 meeting of the Electrochemical Society. Pennington, NJ; Electrochemical Society (1985). (CONF-850542—). Contract AC02-76CH00016.

From 167. Electrochemical Society meeting; Toronto, Ontario, Canada (12 May 1985).

The breakdown of oxide layers of aluminum has been studied using an in situ scanning vibrating electrode technique (SVET) and fast atom bombardment mass spectroscopy (FABMS), which employed a controlled beam of neutral argon atoms to eliminate charging. The rate of breakdown was found to be from 0.6 to 5 events/cm^{2}s. Two types of breakdown sites were observed. One contained Fe and was decorated by Cr and Cl species. The other was identified by the presence of only Cl. No Cl was found in the passive film which was penetrated by the dichromate in the chloridedichromate solution.

25916 Investigation of the order-disorder transition in $ZnSnP_2$ by photoelectrochemical and other techniques. Ryan, M.A. (Solar Energy Research Inst., Golden, CO). pp 800 of Proceedings of the spring 1985 meeting of the Electrochemical Society. Pennington, NJ; Electrochemical Society (1985). (CONF-850542—).

From 167. Electrochemical Society meeting; Toronto, Ontario, Canada (12 May 1985).

$ZnSnP_2$ is a member of the II-IV-V_2 class of semiconductors. These materials are isoelectronic with the III-V and Group IV semiconductors, which account for the majority of applications of semiconductors in technology. The material crystallizes in the chalcopyrite structure, but if the cooling rate of the crystal growth melt is high the material disorders to the sphalerite structure. Although the stoichiometry is the same, the bandgap is a function of the ordering in the material. The authors used photoelectrochemical techniques, Moessbauer spectroscopy, and solid-state NMR to investigate the relationship between the order in the material and the semiconducting properties (carrier mobilities and diffusion lengths, bandgap, etc.).

25917 **Microscopic calculation of electronic structures in metallic glasses.** Ching, W.Y. (Dept. of Physics, Univ. of Missouri - Kansas City, Kansas City, MO). pp 942 of Proceedings of the spring 1985 meeting of the Electrochemical Society. Pennington, NJ; Electrochemical Society (1985). (CONF-850542—). Contract FG02-84ER45170.

From 167. Electrochemical Society meeting; Toronto, Ontario, Canada (12 May 1985).

The electronic structures of metallic glasses are studied by means of first-principle calculations on realistic structural models. The calculated electronic density of states is compared with experimental XPS measurements. The wave function of each electronic state is analyzed in terms of a localization index, with particular attention to states near the Fermi surface. These electronic properties are discussed in relation to the microscopic environment of the constituent atoms in the model structure.

40 CHEMISTRY

4001 Analytical And Separations Chemistry

REFER ALSO TO CITATION(S) 25287, 25439, 25468, 25588, 25939, 26251, 26251

25918 **(AD-A—162339/6/XAB) Atomic and molecular gas-phase spectrometry. Summary report, 1 October 1983-30 September 1985.** Winefordner, J.D. (Florida Univ., Gainesville (USA). Dept. of Chemistry). Oct 1985. 40p. NTIS, PC A03/MF A01.

The major goals of this research have been to develop diagnostical spectroscopic methods for measuring spatial/temporal temperatures and species of combustion flames and plasmas and to develop sensitive, selective, precise, reliable, rapid spectrometric methods of trace analysis of elements present in jet-engine lubricating oils, metallurgical samples, and engine exhausts. The diagnostical approaches have been based upon the measurement of metal probes introduced into the flame or plasmas and the measurement of OH in flames. The measurement approaches have involved the use of laser-excited fluorescence, saturated absorption, polarization, and linear absorption. The spatial resolution in most studies is less than 1 cu mm and the temporal resolution is less than 10 ns with the use of pulsed lasers. Single pulse temperature and species measurements have also been carried out. Other diagnostical studies have involved the measurement of collisional redistribution of radiatively excited levels of Na and Tl in acetylene/O_2/Ar flames and the measurement of lifetimes and quantum efficiencies of atoms and ions in the inductively coupled plasmas, ICP. The latter studies indicate that the high electron number densities in ICPs are not efficient quenchers of excited atoms/ions. Temperatures of microwave atmospheric plasmas produced capacitatively and cool metastable N2 discharge produced by a dielectric discharge have also been measured.

25919 **(BARC—1262) Determination of trace impurities in mullite - a dc arc spectrographic method.** Kamat, M.J.; Kaimal, R.; Malhortra, S.K. (Bhabha Atomic Research Centre, Bombay (India). Spectroscopy Div.). 1985. 11p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86901105.

A dc arc spectrographic method has been developed for the determination of Ca, Cr, Fe, Mn, Mg, Ni, Pb, Ti, and Zn in mullite in the range of 5 to 1000 ppM. The powdered sample is ground with pure graphite powder as buffer in the ratio 1:1. A line (305.99 nm) of Al, a major constituent of the matrix, is used as internal standard. The average precision of the method in terms of the coefficient of variation of concentration is 7 to 11% for different impurities.

25920 **(LA-UR—86-889) Los Alamos installation for the inductively coupled plasma atomic emission spectrometric analysis of radioactive solutions.** Apel, C.T.; Beugelsdijk, T.; Gallimore. D.; Myers, W.H.; Faires, L. (Los Alamos National Lab., NM (USA)). 1986. Contract W-7405-ENG-36. 19p. (CONF-860114—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86008730.

From American Society for Testing and Materials Committee C-26 meeting on nuclear fuel cycle; New Orleans, LA, USA (13 Jan 1986).

This report discusses the selection and installation of an inductively coupled plasma atomic emission spectrometer for the analysis of radioactive solutions. An Applied Research Laboratories 3580 inductively coupled plasma atomic emission combination polychromator and sequential scanning monochromator was selected. Instrument performance, drybox design, interfaces, proposed separation schemes, and laboratory layout are discussed. 6 refs., 6 figs., 3 tabs.

25921 **(TVA/OACD—85/12) Analysis of fertilizer raw materials, intermediates, and products by x-ray fluorescence spectrometry.** Wilhide, W.D.; Ash, D.H. (Tennessee Valley Authority, Muscle Shoals, AL (USA). Office of Agricultural and Chemical Development). 1985. 15p. NTIS, PC A02/MF A01. File Number DE86901145.

In 1976, a minerals beneficiation laboratory was established and investigations begun to explore beneficiating phosphatic raw materials. These laboratory efforts required an economical analytical service which provided rapid turnaround for large numbers of samples. X-ray fluorescence (XRF) spectrometry was selected as the technique most suited to both analytical and research requirements. In 1979 an XRF facility with an automated wavelength-dispersive spectrometer was established in a newly remodeled laboratory. This bulletin provides analytical methodology and operating techniques obtained through six years of experience in the XRF analysis of phosphate raw materials and fertilizer products, by-products, and intermediates.

25922 **LPZ spectral analysis using linear prediction and the z transform.** Tang, J.; Norris, J.R. (Chemistry Division, Argonne National Laboratory, Argonne, Illinois 60439). *Journal of Chemical Physics;* **84**: No. 9, 5210-5211(1 May 1986). Contract W-31-109-ENG-38.

A new method of spectral analysis that combines linear prediction and z-transform, the LPZ is described. LPZ is compared with the fast Fourier transform FFT method of data analysis. The superior frequency resolution and sensitivity and the noise reduction is described when LPZ is used in spectral analysis. (AIP)

25923 **FT-Raman spectroscopy: Development and justification.** Hirschfeld, T.; Chase, B. (Lawrence Livermore National Laboratory, Livermore, California 94550 and Central Research Dept., Du Pont Experimental Station, Wilmington, Delaware 19898). *Applied Spectroscopy;* **40**: No. 2, 133-136(Feb 1986).

The feasibiiity of USMS Fourier Transform Raman spectroscopy for chemical analysis is demonstrated. The advantages of higher resolution, throughout and stability are discussed. (AIP)

4002 Inorganic And Physical Chemistry

REFER ALSO TO CITATION(S) 25301, 25447, 26011, 26172

25924 (DOE/PC/80518—T2) Surface chemistry of model Co-Mo catalysts supported on planar γ-Al_2O_3. Quarterly technical progress report, December 1, 1985-February 28, 1986. Sahin, T.; Ford, W.K. (Montana State Univ., Bozeman (USA)). 1986. Contract FG22-85PC80518. 21p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86008598.

During the second quarter, data for the planar Co-Mo/γ-Al_2O_3 catalyst with Mo+Co deposition order (first Mo then Co) were analyzed and another catalyst sample with reverse metal deposition order was prepared and studied. Work on the single crystal Al (100) oxidation continued. The results have shown that the model Co-Mo catalyst was essentially similar to the industrial porous catalysts in oxide form. Majority of Co and Mo remained as So-Mo interaction ph. se where Co occupied primarily the tetrahedral sites. Determining the geometry of Mo was not possible from the ESCA data. Small amount of Co appeared to move into the Al_2O_3 and occupy the tetrahedral sites in the Al_2O_3 lattice. There was also strong Mo-Al_2O_3 between the Mo layer and Al_2O_3 film. 13 refs. 9 figs., 2 tabs.

25925 (K/PS—5063) Separation of rare earth isotopes using resonance ionization time-of-flight mass spectrometry. Armstrong, D.P.; McCulla, W.H.; Schweitzer, G.K. (Oak Ridge Gaseous Diffusion Plant, TN (USA); Los Alamos National Lab., NM (USA); Tennessee Univ., Knoxville (USA). Dept. of Chemistry). 1985. Contract AC05-84OT21400. 8p. (CONF-8510151—17). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86008897.

From 28. Oak Ridge National Laboratory conference on analytical chemistry; Knoxville, TN, USA (1 Oct 1985).

Stable isotopes comprise a very large portion of the periodic table. They find a wide variety of applications, which include serving as precursors for radioisotopes and radiopharmaceuticals and as accelerated particle targets. Isotopes of the lanthanides, with very high boiling points and low natural abundances, are often difficult to separate by conventional electromagnetic techniques. Photoionization is a potential alternative method. We have devised a system in which an atomic beam of the rare earth metal is admitted to the ionization region of a time-of-flight mass spectrometer. Photoionization is achieved using a pulsed, two-photon laser scheme. Preliminary results from the photoionization of samarium are discussed. 5 refs., 3 figs., 1 tab.

25926 (TVA/OACD—83/17) Precipitated impurities in monoammonium phosphate and their effect on chemical and physical properties of suspension fertilizers. Dillard, E.F.; Frazier, A.W. (Tennessee Valley Authority, Muscle Shoals, AL (USA). Div. of Chemical Development). [1986]. 60p. NTIS, PC A04/MF A01. File Number DE86901151.

The TVA processes for the production of granular ammonium phosphate fertilizers use a preneutralizer or pipe reactor; a rotary drum ammoniator-granulator; accessory equipment for scrubbing off-gases; and equipment for drying, cooling, and sizing the product. Although the main interest in the processes has been in taking advantage of full ammoniation of the phosphoric acid for production of 18-46-0, there has been considerable interest in adapting these processes for production of monoammonium phosphate (MAP). This laboratory study was conducted to identify the solid-phase components in granular MAP, especially the forms of precipitated impurities. The first phase of the laboratory study concerned the identification of solid phases in granular MAP. The second phase of this laboratory study was conducted to correlate physical properties (viscosity and pourability) of 11-33-0 suspensions with the chemical and solid-phase composition of the original MAP from which these suspensions were prepared. The identification of these fertilizer compounds by the use of polarizing light microscopy (PLM), Fourier transform infrared (FTIR) spectroscopy, and x-ray diffraction (XRD) for detailed solid-phase characterization and chemical analysis has provided a more thorough understanding of the composition of MAP fertilizer. 14 refs., 1 fig., 10 tabs.

25927 (TVA/OACD—86/6) Precipitation of impurities in 9-32-0 grade fluid fertilizers. Dillard, E.F.; Scheib, R.M.; Greenwell, B.E. (Tennessee Valley Authority, Muscle Shoals, AL (USA). Office of Agricultural and Chemical Development). [1986]. 34p. NTIS, PC A03/MF A01. File Number DE86901143.

For several years TVA has been studying production of 9-32-0 ammonium polyphosphate suspension produced from ammoniated merchant-grade wet-process orthophosphoric acid. Suspensions containing polyphosphate have an advantage over those that contain only orthophosphate in that they can be stored satisfactorily at much lower temperature. However, the introduction of polyphosphate (pyrophosphate anion) complicates the precipitation of impurities and has yielded inconsistent storage characteristics in 9-32-0 fluid fertilizers. Fluorine also has been shown to affect suspension fertilizer properties. The viscosity of 13-38-0 orthophosphate suspension fertilizers is affected by the atomic ratios F:(Al + Fe + Mg). Addition of fluorine prevents sludges and precipitates in ammonium polyphosphate fertilizer solutions - the proper amount of fluorine is related to the amount of each of the metallic impurities present and also to the fraction of the phosphate present as pyrophosphate. Incorporation of polyphosphate or fluorine or both has been shown to have positive effects on ammoniated wet-process phosphoric acid (WPPA), but they do not report the solubility relationships of the cation impurities (Fe, Al, Mg, and Ca) with respect to the anion constituents (PO_4, P_2O_7, and F). Therefore, a factorial study was developed to determine the solubility relationships of the precipitated metal impurities encountered in 9-32-0 fluid fertilizers. 10 refs., 1 fig., 20 tabs.

25928 (TVA/PUB—86/17) Pilot-plant production of ammonium polyphosphate sulfate suspension fertilizers. Mann, H.C.; McGill, K.E.; Holt, M.T. (Tennessee Valley Authority, Muscle Shoals, AL (USA). Office of Agricultural and Chemical Development). 1984. 25p. (CONF-840805—33). NTIS, PC A02/MF A01. File Number DE86901141.

From 188. meeting of the American Chemical Society; Philadelphia, PA, USA (26 Aug 1984).

TVA is developing a process for production of ammonium polyphosphate sulfate (APPS) suspension fertilizer from merchant-grade wet-process phosphoric acid, 93% sulfuric acid, and anhydrous ammonia. The two acids are simultaneously ammoniated in an "enlarged" pipecross reactor; the molten APPS is dissolved in water; and the fluid then is cooled to room temperature in an evaporative cooler. Attapulgite clay is mixed into the APPS fluid to prevent solids from settling during shipment, storage, and use. The process is energy efficient in that the hot APPS fluid provides all the heat required to preheat the phosphoric acid and vaporize the ammonia. Satisfactory suspension grades up to 11-30-0-3S can be made with 50% of the P_2O_5 present as polyphosphate. The sulfur present in the product should be useful either to reduce sulfur deficiencies in the soil or to provide maintenance dosages of sulfur. The APPS fluid fertilizer can be either applied directly to the soil or used in preparation of mixed suspension products of various ratios. 9 figs., 1 tab.

25929 A radioisotopic tracer method for measurement of solids concentration in a settling bed of solids. Watson, J.S.; Brown, C.H.; Byers, C.H.; Clinton, D.; Perona, J.J. (Chemical Technology Division, Oak Ridge National Laboratory, Oak Ridge, TN 37831). *A.I.Ch.E. Journal (New York);* **32**: No. 2, vp(Feb 1986).

A new improved radiotracer technique provides information on both the particulate concentration and the movement during sedimentation of monodispersed and binary mixtures. In studies of sedimentation with 44 and 62 μm ion exchange particles, several solids concentrations, three fluid viscosities, and three mixtures with different ratios of the two size particles, the results all lie close to a correlation proposed by Richardson and Zaki.

25930 **Differential thermogravimetry analysis and mass spectrometry studies of transition metal macrocycles dispersed on high area carbon.** Scherson, D.; Tanaka, A.; Lattimer, R. (Case Western Reserve Univ., Cleveland, OH). pp 915-916 of Proceedings of the spring 1985 meeting of the Electrochemical Society. Pennington, NJ; Electrochemical Society (1985). (CONF-850542—).

From 167. Electrochemical Society meeting; Toronto, Ontario, Canada (12 May 1985).

The thermal decomposition of highly purified metal-free cobalt and iron μ-oxo tetramethoxyphenyl porphyrin in bulk form and dispersed in high area Vulcan XC-72 carbon have been investigated by differential thermogravimetry analysis and a combination of pyrolysis-gas chromatography and mass spectrometry techniques. The results obtained have indicated that the onset of decomposition of all compounds occurs at a temperature of about 400°C. In addition, it was found that the metal center in the macrocycle tends to suppress quite effectively the release of nitrogen containing fragments during the heat treatment both as pure crystals or supported on carbon.

4003 Organic Chemistry

REFER ALSO TO CITATION(S) 25468, 25935, 26291

25931 **(DPST—86-274) Semiworks evaluation of aqueous degreasers.** Jones, M.K. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 5 Feb 1986. Contract AC09-76SR00001. 14p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86008905.

The 300-Area would like to find a replacement for 1,1,1 trichloroethane (TCE) degreasing solvent. The Area uses TCE to clean organic soils from the surface of certain aluminum tubes and components. While the solvent is an excellent degreaser, it is expensive to use and has properties which make a replacement desirable. At the request of the 300-Area, the Robotics and Fabrication Technology Division evaluated degreasing alternatives and recommended plant testing of Magnus 905XX or Magnu-Spray 205 cleaning compounds. Both compounds are alkaline cleaners that are used in aqueous solution. Both are as effective as 1,1,1 TCE in removing draw bench lubricant from aluminum. The solutions cost $0.25 to 0.30 per gallon. Other commercial users of the cleaners report that the solutions last for at least a month when used with an oil skimmer to separate the organics. 3 refs., 5 figs., 1 tab.

25932 **(LA-UR—85-3936) Using temperature-programmed reaction for kinetic analysis of reactions in dilute aqueous solutions at high pressure.** Brown, L.F.; Robinson, B.A. (Los Alamos National Lab., NM (USA)). 1986. Contract W-7405-ENG-36. 26p. (CONF-860530—2). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86003683.

From 9. international symposium on chemical reaction engineering; Philadelphia, PA, USA (18 May 1986).

The technique of temperature-programmed reaction (TPR) is shown to be a practical experimental method for determining reaction-rate expressions and kinetics parameters for reactions in dilute aqueous solutions under high ambient pressure. By sampling and measuring the extent of reaction during a rise in temperature, information normally obtained from a series of isothermal batch kinetics experiments can be found in a single TPR test. The use of nonlinear least-squares regression eliminates the need to achieve a constant rate of temperature rise, simplifies the experimental requirements for TPR results, and gives more accurate answers than does a linear analysis of TPR results. Numerical simulations of TPR tests in the presence of random concentration-measurement error is used to assess the accuracy of the technique and to identify the best values of crucial operating parameters. The results of two TPR experiments measuring the alkaline hydrolysis of ethyl acetate demonstrate the applicability of the technique to reactions in dilute aqueous solutions at high pressure. These preliminary experimental results, along with numerical simulations, allow us to chart a course for future TPR kinetics experiments on a large number of similar reactions. 16 refs., 6 figs., 8 tabs.

25933 **(NP—6751458) Studies on the product formation in the reaction of oxygen atoms with ethylene.** Temps, F.; Wagner, H.G. (Max-Planck-Institut fuer Stroemungsforschung, Goettingen (Germany, F.R.)). Dec 1982. 19p. (In German). NTIS (US Sales Only), PC A02/MF A01. File Number DE86751458.

Max-Planck-Institut fuer Stroemungsforschung. Bericht. No. 18.

The relative importance of the channel $O+C_2H_4 -> CH_3+HCO$ in the reaction of oxygen atoms with ethylene was determined at room temperature in an isothermal discharge flow reactor with helium as carrier gas. O-atoms and HCO-radicals were monitored by means of a LMR-spectrometer. The sensitivity was determined directly before or after the measurements using different methods. For the concentrations of ethylene and reaction times used the O-consumption was nearly complete. Consecutive reactions played no role. The HCO-consumption which is due to reactions with other products and with O_2 was negligible. The contribution of the channel resulted from the ratio of the concentrations of HCO formed and O consumed. In the pressure regime 1 mbar <= p <= 4 mbar we obtained values between 0,35 <= ksub(1a)/k_1 <= 0,60. (orig./HK).

4004 Electrochemistry

REFER ALSO TO CITATION(S) 25479, 25480, 25746, 25747, 25751, 25915

25934 **(AD-A—162077/2/XAB) Electrochemistry in neutral ambient-temperature ionic liquids. 1. Studies of iron (III), neodymium (III), and lithium(I).** Osteryoung, R.A. (State Univ. of New York, Buffalo (USA). Dept. of Chemistry). 1985. 6p. NTIS, PC A02/MF A01.

An ambient-temperature neutral ionic liquid composed of aluminum chloride and either N-1-butylpyridinium or 1-methyl-3-ethylimidazolium chloride, BuPyCl or ImCl, respectively, was employed in studies that take advantage of their unusual properties. These include an extended electrochemical window, readily controlled additions of excess chloride (base) or aluminum chloride (acid), and the fact that the physical properties of the neutral melt do not change about the 1:1 mole ratio of $AlCl_3$ to RCl. Li^+ was found to be reducible in the neutral $AlCl_3$-ImCl melt, and its diffusion coefficient was found to be .00000086 sq cm/s. The stoichiometry of the complex formed between Nd(III) and Cl^+ in the molten salt system was investigated by what is essentially an amperometric titration and was found to be NdC_6(3-). The structure of the Fe(III) chloro complex that exists in basic or acidic melts just slightly varying in composition from the neutral melt was also investigated; a constant value for the diffusion coefficient-viscosity product in both systems suggests no change in structure.

25935 **Electroreductive cyclization of 1-halo-5-decynes at vitreous carbon in dimethylformamide.** Sho, R.L.; Peters, D.G. (Dept. of Chemistry, Indiana Univ., Bloomington, IN). pp 869 of Proceedings of the spring 1985 meeting of the Electrochemical Society. Pennington, NJ; Electrochemical Society (1985). (CONF-850542—).

From 167. Electrochemical Society meeting; Toronto, Ontario, Canada (12 May 1985).

Cyclic voltammograms for reduction of 1-iodo-5-decyne and 1-bromo-5-decyne at vitreous carbon in dimethylformamide exhibit a single wave for each compound. Large-scale electrolyses yield pentylidenecyclopentane, 5-decyne, and 1-decen-5-yne; the coulometric eta value is unity regardless of potential; the quantity of pentylidenecyclopentane decreases at more negative potentials; and the amounts of 5-decyne and 1-decen-5-yne increase as the potential becomes more negative. These products are formed by competition between one-and two-electron reduction of the 1-halo-5-decynes.

25936 **Polypyrrole complexed with phthalocyanines. A new form of environmentally stable polypyrrole.** Skotheim, T.A.; Rosenthal, M.V.; Florit, M.I.; Linkouns, C.L. (Dept. of Applied Science, Brookhaven National Laboratory, Upton, NY). pp 98 of Proceedings of the spring 1985 meeting of the Electrochemical Society. Pennington, NJ; Electrochemical Society (1985). (CONF-850542—). Contract AC02-76CH00016.

From 167. Electrochemical Society meeting; Toronto, Ontario, Canada (12 May 1985).

Electrically conducting films of polypyrrole complexed with metal phthalocyanines have been synthesized electrochemically from solutions containing sulfonated phthalocyanines as counterions. The films are electrochromic and exhibit four distinctly different color stages. The materials show an unusual degree of environmental stability both as electrodes and as electronic conductors in the ambient atmosphere. The 5 electronic conductivity of polypyrrole-Co-phthalocyanine increases slowly with time upon exposure to the atmosphere, reaching values two orders of magnitude above the starting conductivity after about two months.

25937 **Recent advances in dc relaxation techniques for the measurement of kinetics of fast electrode reactions.** Nagy, Z. (Argonne National Lab., Argonne, IL). pp 704 of Proceedings of the spring 1985 meeting of the Electrochemical Society. Pennington, NJ; Electrochemical Society (1985). (CONF-850542—).

From 167. Electrochemical Society meeting; Toronto, Ontario, Canada (12 May 1985).

Recent advances in the dc relaxation techniques have extended the range of applicability of these techniques to reactions one to three orders of magnitude faster than hitherto measurable. Some of this improvement is due to better instrumentation; however, the major part came from the use of computerized data evaluation. This data-evaluation method has several advantages over the graphical data-evaluation methods commonly used in the past. These advantages are discussed, with special reference to the measurement of kinetics of reactions in high temperature molten salts. Galvanostatic techniques (single and double pulse), coulostatic techniques (charge impulse and current impulse), and potentiostatic techniques (single and double pulse) are discussed in detail, and their relative merits are described. In addition, different methods are discussed for the determination of the reliability of the results. The best method was found to be a statistical analysis coupled to computer curve-fitting data evaluation.

25938 **Chlorine evolving electrodes: On the role of the interfaces on the coating stability.** Atanasoski, R.; Atannasoska, L.G.; Pollak, F.; O'Grady, W.E. (Inst. of Electro Chemistry, Belgrade). pp 610 of Proceedings of the spring 1985 meeting of the Electrochemical Society. Pennington, NJ; Electrochemical Society (1985). (CONF-850542—). Contract AC02-76CH00016.

From 167. Electrochemical Society meeting; Toronto, Ontario, Canada (12 May 1985).

The electrochemical activity and stability are the properties which determine whether an electrode is suitable for industrial applications. In the case of chlorine evolution, the second factor, stability, undoubtedly plays the more important role. The phenomenal stability of a coating of RuOY on Ti is as yet not adequately understood. Therefore, a study of the interface between Ti and single-crystal RuO_2 was undertaken. The experiments were carried out in an ultrahigh vacuum system equipped with XPS. Auger, and LEED. No intermixing between the TiOY and RuOY was observed, and the surface chemistry involving the redox chemistry of TiOY and RuOY was found to play an important role in stabilizing the coating. The results correlate with the well-known behavior of the polycrystalline coatings.

25939 **Molten salt spectroelectrochemistry - Recent developments.** Mamantov, G.; Chapman, D.M.; Hurward, B.L.; Klatt, L.N. (Dept. of Chemistry, Univ. of Tennessee, Knoxville, TN). pp 842 of Proceedings of the spring 1985 meeting of the Electrochemical Society. Pennington, NJ; Electrochemical Society (1985). (CONF-850542—). Contract AC05-84OR21400.

From 167. Electrochemical Society meeting; Toronto, Ontario, Canada (12 May 1985).

Molten salt spectroelectrochemistry is reviewed in this paper. UV-visible transmission, infrared reflectance, resonance and normal Raman, and electron spin resonance spectroelectrochemistry have been used for molten salt studies. Two recent applications of UV-visible transmission spectroelectrochemistry to studies of organic and inorganic solutes in molten $SbCl_3$—$AlCl_3$ butylpyridinium chloride and $AlCl_3$—NaCl are described.

4005 Photochemistry

REFER ALSO TO CITATION(S) 25316, 26170

25940 **Triplet—Triplet Absorption Spectra of Organic Molecules in Condensed Phases.** Carmichael, I.; Hug, G.L. (Radiation Chemistry Data Center, Radiation Laboratory, University of Notre Dame, Notre Dame, Indiana 46556). *Journal of Physical and Chemical Reference Data;* **15**: No. 1, 1-250(Jan 1986).

We present a compilation of spectral parameters associated with triplet—triplet absorption of organic molecules in condensed media. The wavelengths of maximum absorbance and the corresponding extinction coefficients, where known, have been critically evaluated. Other data, for example, lifetimes, energies and energy transfer rates, relevant to the triplet states of these molecules are included by way of comments but have not been subjected to a similar scrutiny. Work in the gas phase has been omitted, as have theoretical studies. We provide an introduction to triplet state processes in solution and solids, developing the conceptual background and offering an historical perspective on the detection and measurement of triplet state absorption. Techniques employed to populate the triplet state are reviewed and the various approaches to the estimation of the extinction coefficient of triplet—triplet absorption are critically discussed. A statistical analysis of the available data is presented and recommendations for a hierarchical choice of extinction coefficients are made. Data collection is expected to be complete through the end of 1984. Compound name, molecular formula and author indexes are appended.

25941 **IR multiphoton decomposition of PH_3-SiH_4 mixtures sensitized by SiF_4.** Blazejowski, J.; Lampe, F.W. (Pennsylvania State Univ., University Park). *Journal of Photochemistry;* **24**: 235-248(1984). Contract AC02-76ER03416.

The SiF_4-photosensitized decomposition of PH_3SiH_4 mixtures by IR radiation at 1025.3 cm^{-1} results in the formation of H_2, SiH_3PH_2 and Si_2H_6 in the gas phase and a solid deposit which is probably a mixture of polymeric P-Si hydrides (PSiH/sub x/). The effects of the composition of the reactant mixture, the pressure, the incident pulse energy and the presence of foreign gases (helium and nitrogen) on the course of the reaction were investigated. It was found that SiH_3PH_2 and Si_2H_6 are formed solely by the insertion of SiH_2 into PH_3 and SiH_4 respectively. A mechanism involving excitation of SiF_4 by absorption of radiation from the CO_2 laser beam and further collisional energy transfer between SiF_4/sup */ and other molecules present in the system is in accord with the experimental results. 42 references, 7 figures.

4006 Radiation Chemistry

REFER ALSO TO CITATION(S) 26548, 26612

4007 Radiochemistry And Nuclear Chemistry

REFER ALSO TO CITATION(S) 25378

25942 **(DOE/ER/01167—48) Nuclear chemistry research. Final report, April 1, 1962-May 31, 1984.** Turkevich, A. (Chicago Univ., IL (USA). Enrico Fermi Inst.). Dec 1985. Contract AC02-76ER01167. 18p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86007184.

Nuclear chemical technqiues and insights have been used to study problems in science ranging from purely nuclear ones to

those involving cosmology, meteorology and space science. In the first category were the first studies of the spallation of copper with both negative and positive mesons, and studies of the spallation of complex nuclei with pions and protons of up to hundreds of GeV. This work was made the basis of the first detailed investigation of the multiplicity of nuclear processes that take place in a solid body (such as the moon or meteorites) when it is exposed over long periods of time to cosmic radiation. Contributions have been made to the development and testing of a new meteorological tracer ($^{13}CD_4$) suitable for experiments on a multithousand kilometer scale. Possible new tracers for this purpose have been proposed. On the cosmological scene, attention has been called to the three locales in our universe where thermonuclear reactions take place leading to the synthesis of helium out of lighter particles. It has been shown that the rates involved reflect the strengths of three of the four fundamental forces of nature.

25943 **New evidence that radon is a metalloid element: ion-exchange reactions of cationic radon.** Stein, L. (Argonne National Lab., IL, USA). *Journal of the Chemical Society (London), Chemical Communications;* No. 22, 1631-1632(15 Nov 1985).

Cationic radon in 1,1,2-trichlorotrifluoroethane displaces hydrogen, sodium, and potassium ions in solid materials, such as Nafion resins (H^+ and K^+ forms), potassium hexafluorophosphate, and sodium hexafluoroantimonate; radon in this state can be quantitatively collected by ion-exchange and eluted with bromine trifluoride in sulphuryl chloride.

4008 Combustion, Pyrolysis, And High-temperature Chemistry

REFER ALSO TO CITATION(S) 25298, 25316, 25317, 25828, 25918

25944 **(AD-A—162163/0/XAB) High-temperature thermal simulator. Technical report, 15 August 1983-15 Septemper 1984 on Phase 1.** Simmons, J.A.; McDonnell, M.D. (Science Applications International Corp., McLean, VA (USA)). 28 Feb 1985. 114p. (SAIC—84/1715). NTIS, PC A06/MF A01.

This report describes the results of a study whose purpose was to determine how and to what extent the radiative output of DNA's Thermal Radiation Simulator (TRS) could be increased. Another purpose was to recommend a program for realizing that higher level of output. This study constituted the first phase of a program whose goals are to create a High Temperature Radiation Simulator (HTRS) producing: a radiative flux exceeding 160 cal/cm^2 - sec and a radiation color temperature effectively greater than 4000° K. The study consisted of an examination of the pertinent literature and some theoretical analyses. The literature examined dealt primarily with the fundamental features of the combustion of metals with oxygen and the radiative and optical characteristics of metal-oxygen combustion products. The theoretical analyses focused on calculation of temperature and energy released from the combustion of various fuels with oxygen, estimation of radiation from a cloud of hot particulates, determination of the approximate relationships between radiative flux and flame height versus flame velocity, paticle size and flame thickness, interpretation of combustion data to determine the burning rates of metal particles, and a qualitative analysis of the fluid dynamic and temperature structure of the present TRS's aluminum-oxygen flame. Based on the results, a set of techniques was defined which could lead to the attainment of the HTRS goals. Additionally, a program of experimental research was outlined to explore, develop and implement these techniques.

25945 **(EPRI-EL—4503) State-of-the-art review: pyrolysis and combustion of PCB substitutes. Final report.** Zbozinek, T.V.; Marsh, J.R.; Guth, D.; Bohrnerud, A. (SCS Engineers, Inc., Long Beach, CA (USA)). Mar 1986. 83p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI86920225.

Utilities are concerned about the possible long-term toxic effects of trace combustion products of potential PCB substitutes. This literature review turned up much information on the bulk combustion products of replacement compounds that are already in wide use but few data on either the trace or bulk products of relatively new materials. 121 refs.

25946 **(PB—86-129145/XAB) Analysis of carbon-particle combustion rates.** Cooper, S. (Central Electricity Generating Board, Southampton (UK). Technology Planning and Research Div.). 1985. 33p. (TPRD/ML—1495/N85). NTIS, PC A05/MF A01.

A model for the combustion of porous carbon particles is described. To allow a relatively simple analysis, the particle is assumed to be isothermal and to have a uniform pore structure. By comparing the characteristic times of the individual processes, four zones of combustion are identified where the overall reaction rate for the particle may be approximated by a single mechanism. As an illustration, these zones are quantified for parameter values typical of pulverised coal chars. Existing data for the reaction rate of char particles are re-analysed using the model and a comparison is made with the analysis using the more usual Field char combustion model which neglects the porosity.

42 ENGINEERING

4201 General Engineering

REFER ALSO TO CITATION(S) 25302, 26793

25947 **(UCRL—52000-86-1) Energy and Technology Review.** (Lawrence Livermore National Lab., CA (USA)). Jan 1986. Contract W-7405-ENG-48. 38p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86007794.

The report is composed of three separate parts: Mutagens in Cooked Food, Precision Engineering at LLNL, and Integrating Computer-Aided Engineering at LLNL. 16 refs., 23 figs., 2 tabs. (WRF)

4202 Facilities And Equipment

REFER ALSO TO CITATION(S) 25372, 25425, 25458, 25835, 25836, 25897, 26713, 26794

25948 **(AD-A—161199/5/XAB) Development of a low-noise 10K refrigeration system. Progress report.** (MMR Technologies, Inc., Mountain View, CA (USA)). Oct 1985. 21p. NTIS, PC A02/MF A01.

The purpose of this contract is the development of a low-noise, closed-cycle, Joule-Thomson refrigeration system for 10K operation. This report summarizes work completed to date on the detailed thermodynamic analysis and physical design of the refrigerator. A complete enthalpy balance for the three-stage device is presented. Fabrication of the first two refrigeration stages (argon and hydrogen) began. A prototype compressor for single-gas operation was designed and tested successfully.

25949 **(AD-A—162890/8/XAB) Basic and applied magnetism with a SQUID gradiometer. Final report, August 1982-August 1983.** Nisenoff, M.N.; Erber, T. (Illinois Inst. of Tech., Chicago (USA)). Dec 1985. 28p. NTIS, PC A03/MF A01.

A facility was established to evaluate the magnetic signatures of cryocoolers, i.e., small closed-cycle liquid-helium refrigerators, by use of a (superconducting) SQUID gradiometer. This gradiometer also was utilized to study the (1) threshold of Barkhausen emission and onset of hysteresis in iron, (2) detection of defects in metal pipes by remote sensing, and (3) magnetoelastic behavior in steel bars.

25950 **(BMI/ONWI—517) Waste package reference conceptual designs for a repository in salt.** (Westinghouse Electric Corp., Pittsburgh, PA (USA)). Feb 1986. Contract AC02-83CH10140. 237p. NTIS, PC A11/MF A01; 1; GPO Dep. File Number DE86008478.

This report provides the reference conceptual waste package designs for the Office of Nuclear Waste Isolation to baseline these

designs, thereby establishing the configuration and interface controls necessary, within the Civilian Radioactive Waste Management Program, formerly the National Waste Terminal Storage Program, to proceed in an orderly manner with preliminary design. Included are designs for the current reference defense high-level waste form from the Savannah River Plant, an optimized commercial high-level waste form, and spent fuel which has been disassembled and compacted into a circular bundle containing either 12 pressurized-water reactor or 30 boiling-water reactor assemblies. For compacted spent fuel, it appears economically attractive to standardize the waste package diameter for all fuel types. The reference waste packages consist of the containerized waste form, a low carbon steel overpack, and, after emplacement, a cover of salt. The overpack is a hollow cylinder with a flat head welded to each end. Its design thickness is the sum of the structural thickness required to resist the 15.4-MPa lithostatic pressure plus the corrosion allowance necessary to assure the required structural thickness will exist through the 1000-year containment period. Based on available data and completed analyses, the reference concepts described in this report satisfy all requirements of the US Department of Energy and the US Nuclear Regulatory Commission with reasonable assurance. In addition, sufficient design maturity exists to form a basis for preliminary design; these concepts can be brought under configuration control to serve as reference package designs. Development programs are identified that will be required to support these designs during the licensing process. 19 refs., 37 figs., 31 tabs.

25951 **(CONF-860434—2) Inverse dynamics position control of a compliant manipulator.** Forrest-Barlach, M.G.; Babcock, S.M. (Oak Ridge National Lab., TN (USA)). 1986. Contract AC05-84OR21400. 33p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86001333.

From IEEE international conference on robotics and automation; San Francisco, CA, USA (14 Apr 1986).

The cycle time of typical industrial manipulators is limited by vibrational characteristics associated with drive train compliance. In this paper the effects of drive train compliance and actuator dynamics in a two-degree-of-freedom manipulator are modeled and a position controller based on inverse dynamics is developed. For comparison, independent joint control neglecting compliance and independent joint control including actuator dynamics and drive train compliance are also considered. Simulation of various controllers is performed utilizing the Advanced Continuous Simulation Language. It is shown that the closed loop frequency response of the manipulator can be increased beyond typical industrial practices by considering the drive train compliance in the design and providing suitable feedback measurements. Simulations suggest that satisfactory performance can be obtained as high as the limit imposed by the manipulators unmodeled higher vibration modes. The controller based on inverse dynamics is shown to effectively decouple the manipulator's nonlinearly coupled degrees of freedom and perform better than a linear independent joint controller which also considers drive train compliance.

25952 **(CONF-860434—5) Concurrent algorithms for autonomous robot navigation in an unexplored terrain.** Rao, S.V.N.; Iyengar, S.S.; Jorgensen, C.C.; Weisbin, C.R. (Oak Ridge National Lab., TN (USA); Louisiana State Univ., Baton Rouge (USA)). 1986. Contract AC05-84OR21400. 23p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86006089.

From IEEE international conference on robotics and automation; San Francisco, CA, USA (14 Apr 1986).

Navigation planning is one of the vital aspects of any autonomous mobile robot. In this paper, we present concurrent algorithms for an autonomous robot navigation system that does not require a pre-learned obstacle terrain model. The terrain model is gradually built by integrating the information from multiple journeys. The available information is used to the maximum extent in navigation planning, and global optimality is gradually achieved. It is shown that these concurrent algorithms are free from deadlocks and starvation. The performance of the concurrent algorithms is analyzed in terms of the planning time, travel time, scanning time, and update time. A modified adjacency list is proposed as the data structure for the spatial graph that represents an obstacle terrain. The time complexities of various algorithms that access, maintain, and update the spatial graph are estimated, and the effectiveness of the implementation is illustrated.

25953 **(CONF-860560—1) Duty cycle testing and performance evaluation of the SM-229 teleoperator.** Stoughton, R.S.; Kuban, D.P. (California Univ., Santa Barbara (USA); Oak Ridge National Lab., TN (USA)). Nov 1985. Contract AC05-84OR21400. 28p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86004780.

From 20. aerospace mechanism symposium; Cleveland, OH, USA (7 May 1986).

This paper contains the first known experimental studies and analyses of teleoperator performance for specific duty cycles. The results are presented in two distinct areas as position usage patterns, and as three-dimensional power grids. The position usage patterns are a valuable means to assess the available motion range. The power grids are a unique concept for evaluating joint performance. Final conclusions contain recommendations to upgrade the teleoperator for optimum performance. 3 refs., 16 figs.

25954 **(DOE/CE/15144—T2) Jet-engine combustor spectral radiation measurements using fiberoptic instrumentation system. Radiant energy power source for jet aircraft. Final report.** Doellner, O.L. (Doellner (O.L.), Tucson, AZ (USA)). Feb 1986. Contract FG01-82CE15144. 121p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE86007289.

This report is a summary of spectral radiation measurements made at Williams Air Force Base, Chandler, Arizona on a General Electric J-85-5 engine. The spectral radiation measurements consisted of a complete axial profile down the combustor and are directed toward the application of Radiant Energy Power Source for Jet Aircraft. Radiant Energy Power Source for Jet Aircraft relates to the use of photovoltaic cells to generate the electrical power demands of the aircraft. The photovoltaic cells are mounted inside the casing of the jet engine, are thermally insulated from the normally hot engine casing, and are appropriately cooled. The photovoltaic cells receive their required radiant energy from the combustion flame by holes in the combustion liner. The instrumentation system used to make these measurements employed fiberoptic probes - entering the engine by way of an existing (modified) access plate - to obtain the radiation measurements. Such an instrumentation system has the strong advantage of being able to measure radiation from all the holes running axially down the combustor without making any holes in the plenum/engine casing - as would be necessary if sapphire observation windows were used. This report is thus more than a discussion of spectral radiation measurements made on a jet engine: it is also a report of the design and evolution of the fiberoptic instrumentation system used to make these measurements. The instrumentation system was designed and built from fundamental first principles, as described in detail in this report. It is believed that this fiberoptic instrumentation system will find application with gas-turbine manufacturers.

25955 **(DOE/ER/40121—6) AE monitoring instrumentation for high performance superconducting dipoles and quadrupoles, Phase II. Progress report, February 1, 1985-January 31, 1986.** Iwasa, Y. (Massachusetts Inst. of Tech., Cambridge (USA)). 22 Jan 1986. Contract AC02-83ER40121. 105p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE86007414.

In the past year and a half, attention has been focused on the development of instrumentation for on-line monitoring of high-performance superconducting dipoles and quadrupoles. This instrumentation has been completed and satisfactorily demonstrated on a prototype Fermi dipole. Conductor motion is the principal source of acoustic emission (AE) and the major cause of quenches in the dipole, except during the virgin run when other sources are also present. The motion events are mostly microslips. The middle of the magnet is most susceptible to quenches. This result agrees with the peak field location in the magnet. In the virgin state the top and bottom of the magnet appeared acoustically similar but diverged after training, possibly due to minute structural asymmetry, for example differences in clamping and welding strength; however, the results do not indicate any major structural defects. There is good correlation between quench current and AE starting current. The correlation is reasonable if mechanical disturbances are indeed responsible for quench. Based on AE cumulative history, the average frictional power dissipation in the whole dipole winding is estimated to be $\sim 10\ \mu W\ cm^{-3}$. We expect to implement the following in

the next phase of this project: Application of room-temperature techniques to detecting structural defects in the dipole; application of the system to other dipoles and quadrupoles in the same series to compare their performances; and further investigation of AE starting current ~ quench current relationship. Work has begun on the room temperature measurements. Preliminary Stress Wave Factor measurements have been made on a model dipole casing.

25956 **(IC—84/113) Convective heat losses due to wind in flat plate solar collectors.** Agarwal, V.K. (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1984. 11p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701392.

The determination of the top loss coefficient of a flat plate collector critically depends on convective heat losses due to wind (hsub(WC)). This paper critically analyzes the commonly used McAdams' relation for hsub(WC), which yields significantly higher values of hsub(WC), and does not take into account the nature of the air flow (laminar or turbulent) and the temperature dependence of physical properties of air. It is further discussed that in practical situations one should consider a transition from laminar to turbulent flow at a critical distance from the leading edge of the collector in order to calculate hsub(WC). A qualitative comparison of data is given using McAdams' relation and other relations governing purely laminar, purely turbulent or mixed flow conditions. The best fit equations for calculating the needed physical properties of air at different temperatures are also given. (author). 3 figs.

25957 **(K/D—5697) In-house CAD training: a realistic approach.** Whitus, T. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 10 Apr 1986. Contract AC05-84OT21400. 11p. (CONF-8604150—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE86008926.

From American Institute for Design and Drafting convention; Hollywood, FL, USA (7 Apr 1986).

The need for industry to retrain its engineering personnel to use a CAD system can be demanding, as well as frustrating. In fact, the larger and more diverse the organization, the more demanding these requirements may be. It should be noted that in preparing for CAD implementation, the training needs and requirements are often underestimated. Additionally, most engineering organizations implementing CAD do not have personnel experienced in developing training programs or in teaching manipulative skills. This text describes the evolution of the in-house CADAM basic training program at Martin Marietta Energy Systems, Inc. Rather than emphasize the theoretical aspects of designing such a program, the paper will concentrate on the practical, more realistic aspects of program development. The paper should serve as a guide to others desiring to develop a similar program. This paper first presents a brief look at factors concerning retraining the experienced engineering employee. Then, the actual planning, organization, structuring, implementation, and evaluation of the training program, as well as possible future directions are presented. Finally, the paper offers advice to those planning similar in-house CAD training programs.

25958 **(LA-UR—86-861) Numerical predictions of railgun performance including the effects of ablation and arc drag.** Schnurr, N.M.; Kerrisk, J.F.; Parker, J.V. (Los Alamos National Lab., NM (USA)). 1986. Contract W-7405-ENG-36. 7p. (CONF-8604147—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86008718.

From 3. symposium on electromagnetic launch technology; Austin, TX, USA (20 Apr 1986).

Thermal radiation from plasma armatures in railguns may cause vaporization and partial ionization of the rail and insulator materials. This causes an increase in mass of the arc, which has an adverse effect on projectile velocity. Viscous drag on the arc also has a deleterious effect, particularly at high velocities. These loss mechanisms are modeled in the Los Alamos Railgun Estimator code. Simulations were performed and numerical results were compared with experimental data for a wide range of tests performed at the Los Alamos and Lawrence Livermore National Laboratories, the Ling Temco Vought Aerospace and Defense Company, and the Center for Electromechanics at the University of Texas at Austin. The effects of ablation and arc drag on railgun performance are discussed. Parametric studies illustrate the effects of some design parameters on projectile velocity and launcher efficiency. Some strategies for reducing the effects of ablation are proposed.

25959 **(LA-UR—86-941) Predicting bore deformations and launcher stresses in railguns.** Davidson, R.F.; Cook, W.A.; Rabern, D.A.; Schnurr, N.M. (Los Alamos National Lab., NM (USA)). 1986. Contract W-7405-ENG-36. 7p. (CONF-8604147—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86008738.

From 3. symposium on electromagnetic launch technology; Austin, TX, USA (20 Apr 1986).

The structural responses of launchers are important because they affect the projectile performance and the operating limits of the railgun system. Structural analysis makes it possible to make better decisions in launcher design. Example analyses of the Los Alamos HIMASS and Lethality Test System launchers are presented in this paper. Also, a discussion of the benefits and limitations of these analyses is included.

25960 **(LA-UR—86-942) Launcher barrel for the lethality test system railgun.** Sims, J.R.; Christensen, K.E.; Cummings, C.E.; Calkins, N.C. (Los Alamos National Lab., NM (USA)). 1986. Contract W-7405-ENG-36. 5p. (CONF-8604147—7). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86008739.

From 3. symposium on electromagnetic launch technology; Austin, TX, USA (20 Apr 1986).

A reusable plasma armature railgun barrel design is described. This barrel was designed and is being fabricated at the Los Alamos National Laboratory for use in a kinetic energy lethality test system. The performance goals for this barrel are (1) that it be able to withstand the loads generated when accelerating a 30-g projectile to a velocity of 15 km/s without sustaining permanent damage, (2) that it have multiple shot capability, and, (3) that it be capable of being repaired and/or modified. The barrel consists of a multipiece modular core contained in an outer structural shell. The core assembly, composed of rails and insulators, is accessible for repair or replacement. The outer structural shell is designed to allow access to the core and is used to preload the core compressively. The barrel design incorporates various features that will allow the use of stronger and stiffer materials such as structural ceramics and reinforced coppers as they become available.

25961 **(LA-UR—86-943) Experimental measurement of ablation effects in plasma armature railguns.** Parker, J.V.; Parsons, W.M. (Los Alamos National Lab., NM (USA)). 1986. Contract W-7405-ENG-36. 9p. (CONF-8604147—3). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86008740.

From 3. symposium on electromagnetic launch technology; Austin, TX, USA (20 Apr 1986).

Experimental evidence supporting the importance of ablation in plasma armature railguns is presented. Experiments conducted using the HYVAX and MIDI-2 railguns are described. Several indirect effects of ablation are identified from the experimental results. An improved ablation model of plasma armature dynamics is proposed which incorporates the restrike process.

25962 **(LA-UR—86-991) Building control system using redundant VAX and CAMAC technologies.** Nelson, D.C. (Los Alamos National Lab., NM (USA)). 1986. Contract W-7405-ENG-36. 5p. (CONF-8604148—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE86008747.

From Ideas in science and electronics conference; Albuquerque, NM, USA (29 Apr 1986).

The plutonium facility at Los Alamos National Laboratory is installing a building environmental monitoring and control system utilizing redundancy as much as possible. The installation will monitor and control heating, ventilation, power, radiation monitors, fire sensors, and the criticality system. This paper describes the hardware environment chosen for this application, along with some of the problems encountered in developing redundant operation. A unique part of the system is the field data concentrator, which has no permanent storage media and relies on an Ethernet link for all operations, including the loading of its system at bootup.

25963 **(LA-UR—86-1027) Global coordinates and exact aberration calculations applied to physical optics modeling of complex optical systems.** Lawrence, G.; Barnard, C.; Viswanathan, V.K. (Los Alamos National Lab., NM (USA)). 1986. Contract W-7405-ENG-36. 8p. (CONF-860366—3). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86008751.

From SPIE technical symposium on applications of artificial intelligence; Orlando, FL, USA (31 Mar 1986).

Historically, wave optics computer codes have been paraxial in nature. Folded systems could be modeled by "unfolding" the optical system. Calculation of optical aberrations is, in general, left for the analyst to do with off-line codes. While such paraxial codes were adequate for the simpler systems being studied 10 years ago, current problems such as phased arrays, ring resonators, coupled resonators, and grazing incidents optics require a major advance in analytical capability. This paper describes extension of the physical optics codes GLAD and GLAD V to include a global coordinate system and exact ray aberration calculations. The global coordinate system allows components to be positioned and rotated arbitrarily. Exact aberrations are calculated for components in aligned or misaligned configurations by using ray tracing to compute optical path differences and diffraction propagation. Optical path lengths between components and beam rotations in complex mirror systems are calculated accurately so that coherent interactions in phased arrays and coupled devices may be treated correctly.

25964 **(MCR—84-1878) Space station automation study. Volume I. Executive summary. Autonomous systems and assembly. Final report.** (Martin Marietta Corp., Denver, CO (USA). Denver Aerospace). Nov 1984. 64p. NTIS, PC A04/MF A01. File Number DE85902179.

The purpose of the Space Station Automation Study (SSAS) was to develop informed technical guidance for NASA personnel in the use of autonomy and autonomous systems to implement Space Station functions.

25965 **(PB—86-120573/XAB) IHI (Ishikawajima-Harima Heavy Industries) Engineering Review, Vol. 25, No. 4, July 1985.** (Ishikawajima-Harima Heavy Industries Co. Ltd., Tokyo (Japan)). 1985. 81p. NTIS, PC A04/MF A01.

Some Experiments on Shallow Water Effects on Maneuvering Hydrodynamic Forces Acting on a Ship Model; Structural Analysis of Artic Mobile Island; Design of Performance and Analysis of Dynamic and Transient Thermal Behaviors on the Intermediate Heat Exchanger for HTGR; Dynamic Characteristics of LPG Vaporizer (III); Combustion Characteristics of Diesel Fuel Spray in High Pressure and High Temperature Atmosphere; An Opto-Electronic Measurement System for Vessel Motion in Waves; Design and Application of New Type Engine Stay for Minimal Vibration in Ships; Forming Technique of Short Radius Bent Pipes and Its Design; Kawajiri 3rd Bridge for Osaka Prefectural Ikeda Construction Office and technical features of IHI products.

25966 **(SAND—85-1369) Test specification for TRUPACT-I vibration assessment.** Gwinn, K.W.; Glass, R.E.; Romesberg, L.E. (Sandia National Labs., Albuquerque, NM (USA)). Feb 1986. Contract AC04-76DP00789. 22p. (TTC—0566). NTIS, PC A02/MF A01; GPO Dep. File Number DE86007448.

This test specification establishes the requirement for the vibration assessment of the Transuranic Package Transporter (TRUPACT-I). Unit 1 will be temporarily taken out of service to perform the tests. The testing will encompass monitoring of the in-service and road simulator vibration environments and post-test inspection of the unit. This testing will provide data on the response of the package to the in-service vibration environment through the equivalent of one million miles of service.

25967 **(SAND—86-0528C) Fabrication of quartz resonators by float polishing.** Jungling, K.; Soares, S.; Koehler, D. (New Mexico Univ., Albuquerque (USA). Center for High Technology Materials; Sandia National Labs., Albuquerque, NM (USA)). 1986. Contract AC04-76DP00789. 5p. (CONF-8604148—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86007616.

From Ideas in science and electronics conference; Albuquerque, NM, USA (29 Apr 1986).

AT-cut crystalline quartz blanks that are polished with conventional techniques generally fracture at much lower tensile-stress levels than the theoretical value. The fractures initiate at microcracks which are present on the surfaces and edges of these blanks, and which are caused by lapping and polishing techniques utilized in their manufacture. To obtain precision quartz frequency standards that can withstand a high-G environment a new polishing technique, float polishing, was employed. Blanks 6.35 mm in diameter and 175 μm thick were float polished - to a thickness corresponding to an operating frequency of 16 MHz - in two batches using fumed SiO_2 and colloidal SiO_2. A third batch was polished to this same frequency using TiO_2 in the float polishing apparatus. These three batches were then evaluated for surface roughness, parallelism, overall surface and edge quality, and stress-failure threshold. Initial results indicate that the batch that was float polished with colloidal SiO_2 yielded the most improvement, and on an average the stress-failure threshold for this batch improved by a factor of two as compared with conventionally processed blanks. The fractures appear to initiate primarily at imperfections on the edges of these samples.

25968 **(TRW—Z410.1-84-160) Space station automation study: satellite servicing. Volume I. Executive summary.** (TRW Space and Technology Group, Redondo Beach, CA (USA)). 30 Nov 1984. 45p. TRW Space and Technology Group, One Space Park, Redondo Beach, CA 90278. File Number TI85902180.

This study was conducted by TRW over the six month time frame from early June through November 1984. Three major tasks were completed: Servicing Requirements (Satellite and Space Station Elements) and the Role of Automation; Assessment of Automation Technology; and Conceptual Design of Servicing Facilities on the Space Station. It was found that many servicing functions could benefit from automation support; that certain research and development activities on automation technologies for servicing should start as soon as possible; and some advanced automation developments for orbital servicing could be effectively applied to US industrial ground based operations. 21 figs.

4203 Lasers

REFER ALSO TO CITATION(S) 26031, 26040, 26730

25969 **(AD-A—162037/6/XAB) Study of cold-cathode and rf excitation for low-power CO_2 waveguide lasers. Final report.** Hochuli, U. (Maryland Univ., College Park (USA). Dept. of Electrical Engineering). Oct 1985. 35p. NTIS, PC A03/MF A01.

Initial results indicate that transversely rf-excited 2W c-w CO_2 waveguide lasers can be built to last in excess of 10000 hours. This result was achieved with either internal electrodes or capacitive wall coupling and with either CO- or N_2-bearing gas mixtures. On-off switching seems to be quite well tolerated. Rf conductance and starting-voltage measurements for six different gas mixtures and four pressure parameters are given.

25970 **(AD-A—162100/2/XAB) Photon-avalanche-laser improvement program. Final report, November 1983-November 1984.** Koch, M.E. (LTV Aerospace and Defense Co., Dallas, TX (USA). Vought Missiles Advanced Program Div.). Dec 1984. 73p. NTIS, PC A04/MF A01.

The main thrust of this program was to increase the output power and efficiency of a photon-avalanche laser demonstrated in an earlier and related program. However, material problems plagued the effort from the outset. Identification and solution of these problems led to an enormous increase in production yield of Pr-doped $LaCl_3$ laser crystals as well as the discovery of a contaminate that needs to be eliminated in future work. Overall, an increase in laser power output has not achieved, but new insights may lead to large payoffs in the near future.

25971 **(AD-A—162712/4/XAB) Spectral diversity crystalline fluoride lasers.** Jenssen, H.P.; Gabbe, D.R.; Linz, A.; Naiman, C.S. (Massachusetts Inst. of Tech., Cambridge (USA)). 1981. 20p. NTIS, PC A02/MF A01.

Within the realm of crystalline laser materials, the class of fluorides distinguishes itself mostly by the wide variety of laser wavelengths displayed. Laser operation has now been reported from 3.9 micrometers in the infrared to 286 nm in the ultraviolet. Many are operated flash-lamp pumped, while others have shown high utility as linear down conversion lasers and rare earth ion, while others are sensitized by other co-dopants which absorb the pump energy and transfer it to the active laser ions. The potential of large spectral diversity for laser operation is due both to the wide window of transparency that fluorides possess and the lower rates of nonradiative decay. The high band gap in the ultraviolet also leads to low linear absorption, low nonlinear refractive indices and multiphoton absorption. Additionally, the good chemical stability displayed by high-purity stoichiometric fluoride compounds allows their use with ultraviolet pump sources at high energies, without incurring UV-induced damage. The most recent research associated with such materials, particularly the host crystal, lithium yttrium fluoride, LiYF4 (YLF) is reviewed.

25972 **(AD-A—163106/8/XAB) Diode Pumped fiber laser. Interim report, 1 September 1983-2 July 1984.** (Stanford Univ., CA (USA). Edward L. Ginzton Lab.). Dec 1984. 101p. (GL—3756). NTIS, PC A06/MF A01.

This report describes work conducted in the area of single-crystal fiber-optical devices. Miniature Nd:YAG 1.32 μm lasers were fabricated using both free space (unguided) and single crystal fiber configurations. Bulk lasers with thresholds as low as 19 mW and near-optimum slope efficiencies of 36% were demonstrated. Several guided fiber lasers were also successfully brought to oscillation. The best device has a threshold of 12 mW, a slope efficiency of 22%, and a maximum recorded output power at 1.32 μms of 22 mw. Fiber scattering properties inferred from these measurements indicate that the crystal fiber used in this work exhibit a much higher quality than the fibers used in earlier phases of this work as a result of improved growth conditions. A theoretical investigation of 1.32 μms optically-pumped lasers was also developed for interpretation of experimental data. A feasibility study of Q-switched fiber lasers operating near lambda = 1.06 μms was also conducted. Theoretical expressions for the laser-output peak power, pulse width, and energy were cast in a simple form by implementing the formalism of normalized mode overlap coefficient introduced earlier in this work. Peak powers on the order of 100-500 watts and pulse widths of a few nanoseconds are anticipated for fiber lasers.

25973 **(AD-A—163141/5/XAB) Investigation of plasma processes in electronic transition lasers. Annual report, 1 January-31 December 1985.** Nighan, W.L. (United Technologies Corp., East Hartford, CT (USA). Research Center). 15 Dec 1985. 28p. (UTRC/R—85-927162-1). NTIS, PC A03/MF A01.

This is an investigation of the fundamental processes affecting the operation, performance and applications of electrically excited lasers having potential utility in a variety of areas of importance to the Navy. Particular attention is presently focused on the broadband XeF(C is then A) laser, which has the potential for efficient, tunable operation throughout the blue-green spectral region. The research at UTRC is closely coordinated with a complementary ONR-supported experimental program being conducted at Rice University. This Annual Report summarizes recent results of this investigation, and includes reprints of recently published papers in which specific results and conclusions of the research are described in detail: transient absorption in the visible region; rare gas-halide mixture synthesis; efficient XeF(C is then A) laser, tunable visible laser, tunable blue-green laser.

25974 **(AD-A—163201/7/XAB) Blue laser. Final technical report, September 1984-November 1985.** Griffin, G.R. (Xerox Special Information Systems, Pasadena, CA (USA)). Dec 1985. 33p. NTIS, PC A03/MF A01.

This has been a development program to design a low-noise, moderate-power, blue, hollow-cathode laser used for imaging on photoconductors for on-demand color printing. Descriptions of the construction, processing, and testing of experimental units are presented with recommendations for design improvements.

25975 **(AD-A—163227/2/XAB) Proposal for FEL experiments driven by the National Bureau of Standards c-w microtron. Memorandum report, October 1984-September 1985.** Sprangle, P.; Penner, S.; Kincaid, B.M.; Freeman, R.R. (Naval Research Lab., Washington, DC (USA)). 31 Dec 1985. 11p. (NRL-MR—5709). NTIS, PC A02/MF A01.

Free-electron-laser experiments driven by the racetrack microtron (RTM) are proposed. The design of RTM has many exceptional properties: i) normalized transverse emittance of 10 mm mrad, comparable to a storage ring, ii) axial emittance <30 keV-degree, much superior to rf linacs, iii) electron energy tunable from 20 to approximately 200 MeV, iv) C-W operation, v) energy stability, vi) compactness, and vii) high power-conversion efficiency. Accelerator up-grades are proposed to increase the peak current and to recover a significant part of the electron-beam energy. It seems possible to obtain peak current of 5-10A for electron pulse length of approx. 1.2 mm. Conservative estimates are made based on a peak current of 1.0 A in estimating the performance of the FELs to be used with the RTM. Low-gain calculations indicate that the FEL can oscillate at the fundamental wavelength ranging from 0.15 to 100 micrometers. Furthermore, outline experiments will be performed to generate harmonics in the extreme-ultraviolet region.

25976 **(AD-A—163297/5/XAB) Three-dimensional numerical simulations of FELS by transverse mode spectral method. Memorandum report.** Sprangle, P. (Naval Research Lab., Washington, DC (USA)). 30 Dec 1985. 28p. (NRL-MR—5694). NTIS, PC A03/MF A01.

A numerical method is presented for solving a three-dimensional radiation field by decomposing the radiation field into transverse modes that satisfy the free-space wave equation and the boundary conditions. The formalism includes betatron oscillations in a realizable wiggler, finite emittance, and energy spread in an amplifier or oscillator configuration. This formalism can be generalized to calculate sidebands resulting from the synchrotron oscillations. The transverse mode-spectral method is compared with the finite-difference method, spectral method and transform spectral method. Examples from a computer code using Gaussian-Hermite expansion are given. Self-focusing of the radiation beam due to gain and refraction of the free electron laser is shown.

25977 **(AD-A—163387/4/XAB) Initiator duration effect on pulsed chain-reaction chemical-laser scaling laws. Technical report.** (Aerospace Corp., El Segundo, CA (USA)). 15 Nov 1985. 52p. (TR—0086(6930-01)-3). NTIS, PC A04/MF A01.

The effect of initiator pulse duration on the performance of a pulsed chain reaction chemical laser is investigated using a two-level vibrational model. Analytic results are presented for a saturated laser in the limits of weak and strong initiation. The initiator is assumed to provide a uniform (e.g., electron beam), parabolic (e.g., flash lamp), or power law variation of F-atom production rate F/ sub B/ with time. Laser performance is presented as a function of t/sub B//t/sub e/ where t/sub B/ and t/sub e/ are initiator and laser pulse times, respectively. In the weak initiation regime, an increase of t/sub B//t/sub e/ from zero to one results in a decrement in laser output energy of 20 and 33-1/3% for a flash lamp and electron-beam initiator, respectively. In the strong initiation regime, an increase of t sub B/t sub e fom zero to one results in an energy decrement of only 5 and 10% for a flash lamp and electron-beam initiator, respectively. In each case, the laser pulse time t/sub e/ is increased by a factor of two as t/sub B//t/sub e/ increases from zero to one.

25978 **(DOE/ER/13309—2) Research on x-ray optics with the ultimate aim of producing a synchrotron radiation pumped soft x-ray lithium laser. Progress report, January 1-October 1, 1985.** Csonka, P. (Oregon Univ., Eugene (USA)). 28 Feb 1986. Contract FG06-85ER13309. 18p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86008052.

This report covers a 9.5 month period starting on January 1, 1985, and ending on October 14, 1985. During the reporting period,

we have met our research goals as set forth in our original proposal. Our first task was to investigate a variety of focusing devices with the aim of generating at the focus a high flux of x-ray photons, per unit surface area, per unit time. Information is presented on the design, development, and specifications of the selected high performance ellipsoidal mirror. (JDB)

25979 **(ENEA-RT-TIB—84-37) Electron-beam sustained discharge XeCl laser.** Fiorentino, E.; Letardi, T.; Marino, A.; Sabia, E.; Vannini, M. (ENEA, Rome (Italy)). 1984. 37p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86701504.

In this work the construction characteristics and performances of a laser system operating with e-beam sustained discharge are described. Operating with XeCl, the laser pulse energy is over 4J. Details of the measurements on the system are also reported.

25980 **(ENEA-RT-TIB—84-39) Light for the future: excimer and free electron lasers.** Letardi, T.; Renieri, A. (ENEA, Rome (Italy)). 1984. 25p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701505.

The status of the art of two interesting kind of coherent radiation sources (excimer and free electron lasers) is described. The working principles of excimer lasers is analyzed together with the most relevant characteristics (active media, operating wavelenght, average and peek power, spectrum and time structure). As to the free-electron laser, whose development is at the very first stage, theoretical and experimental aspects are described and perspectives for the future are discussed.

25981 **(LA-UR—86-770) Narrow band tuning with small long pulse excimer lasers.** Sze, R.C.; Kurnit, N.; Watkins, D.; Bigio, I. (Los Alamos National Lab., NM (USA)). Dec 1985. Contract W-7405-ENG-36. 19p. (CONF-851208—3). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86007368.

From 8. international conference on lasers; Las Vegas, NV, USA (2 Dec 1985).

We discuss frequency narrowing and tuning with simple dispersion elements with small long-pulse excimer lasers. The improved performance over short-pulse lasers is discussed and attributed to the increased number of round trips. A physical model of the dynamics of line narrowing is presented.

25982 **(PB—86-130853/XAB) Science and Engineering Research Council Central Laser Cacility: annual report to the Laser Facility Committee 1985.** (Rutherford Appleton Lab., Chilton (UK)). 1985. 283p. (RAL—85-047). NTIS, PC A12/MF A01.

Contents include: Part I - SERC central laser facility - glass laser scientific program, ultraviolet radiation facility scientific program, and high power KrF laser program; Part II - lasers for microcircuit fabrication; and Central Laser Facility publications.

25983 **(PB—86-143336/XAB) Beam shaping in a high-power laser system.** Roschger, E.W. (Bern Univ. (Switzerland). Inst. fuer Angewandte Physik). 18 Jan 1984. 49p. NTIS, PC A03/MF A01.

Maximum energy extraction and rectangular intensity distribution from a high-power laser system reflects a trade-off between three conflicting requirements: (1) efficient energy extraction; (2) propagation without beam break-up (caused by Fresnel diffraction effects, for example); (3) homogeneous rectangular distribution of the beam intensity in the far field, i.e. at the target position. In this paper the adaptation of the Gaussian input pulse to the amplifier stages by magnification and apodization to compensate for the radial gain profiles is reported. With the measured radial gain profiles, the input profile required for maximum energy extraction and rectangular intensity distribution at the laser output is calculated. A detailed description is given for the fabrication of the metal-coated apodized aperture. The output profiles are simulated for various excitation levels of the amplifiers and compared with experimental data.

25984 **Diode-laser-pumped Nd:YAG laser injection seeding system.** Schmitt, R.L.; Rahn, L.A. (Sandia National Laboratories, Combustion Research Facility, Livermore, California 94550). *Applied Optics;* **25**: No. 5, 629-633(1 Mar 1986).

We have designed and tested a compact injection seeding system consisting of a diode-laser-pumped Nd:YAG master oscillator and a permanent-magnet Faraday isolator. With active resonator frequency stabilization, this system permits highly reliable single-axial-mode operation of a Q-switched Nd:YAG laser over a period of hours. The system is capable of injection seeding both stable and unstable resonator designs and is suitable for injection seeding commercial lasers with only minor modifications.

25985 **Electro-optical switching and memory display device.** Skotheim, T.A.; O'Grady, W.E.; Linkous, C.A. (to Dept. of Energy). US Patent 4,571,029. 18 Feb 1986. Filed date 29 Dec 1983. vp.

An electro-optical display device is described comprising: wall means defining a housing, the wall means including a transparent wall and at least one other wall; display electrode means positioned on the inner side of the other wall; counter electrode means positioned on the inner side of the transparent wall; a thin electrically conductive polymer film incorporating pigment molecules embedded as counter ions, the film being disposed over the display electrode; an electrolyte disposed within the housing and in conductive relationship with the counter electrode and the film over the display electrode; the display electrode and the counter electrode are adapted to have electric circuit means connected to them for selectively varying the electric potential applied by them across the electrolyte and the polymer film; the device is operable to electronically and rapidly change the pigment molecules embedded in the polymer film, responsive to predetermined variations in the electric potential applied across the film, thereby to selectively quickly change the color of the film as it is seen through the transparent wall.

25986 **Fiber optics temperature and pressure probe.** Hirschfeld, T.; Wang, F.; Haugen, G.; Hieftje, G. (Lawrence Livermore National Lab., Livermore, CA). pp 19-23 of Analytical spectroscopy. Lyon, W.S. New York, NY; Elsevier (1984). (CONF-831025—). Contract W-7405-ENG-48.

From 26. ORNL-DOE conference on analytical chemistry in energy technology; Knoxville, TN, USA (11 Oct 1983).

The half life, the line width, and ratio of peak intensities of the R_1 and R_2 ruby lines are only a function of temperature, while the shift in line position and the absolute intensities are functions of both the pressure and temperature. The emission from an optical fiber with a ruby tip encodes both the temperature and pressure of the fiber tip. Both the temperature and the pressure can be deduced by analyzing this spectroscopic information.

25987 **Optimized rotary flux compressors for powering laser flashlamps.** Lundberg, R.; Cardner, B. (Lawrence Livermore National Lab., P.O. Box 5508, L-490, Livermore, CA). pp 669-671 of Fourth IEEE pulsed power conference. Rose, M.F.; Martin, T.H. New York, NY; Institution of Electrical and Electronics Engineers (1983). (CONF-830621—). Contract W-7405-ENG-48.

From IEEE power electronics specialists conference; Albuquerque, NM, USA (6 Jun 1983).

Very large rotary flux compressors provide one means to power large laser systems in the future. These machines are the only devices that have the demonstrated ability to convert rotating inertial energy into high power, millisecond electrical pulses. The authors have studied the active rotary flux compressor (ARFC) with a code developed by Eimerl and Goodwin at LLNL from work originated at UT, Austin. The purpose was to evaluate the cost effectiveness of the ARFC's for use in powering flashlamps that pump Nd-glass laser amplifiers.

25988 **Pulse power for the Rapier "B Amplifier" KrF laser system.** Schlitt, L.G. (Lawrence Livermore National Lab., Univ. of California, P.O. Box 5508, L-490, Livermore, CA). pp 736-739 of Fourth IEEE pulsed power conference. Rose, M.F.; Martin, T.H. New York, NY; Institution of Electrical and Electronics Engineers (1983). (CONF-830621—). Contract W-7405-ENG-48.

From IEEE power electronics specialists conference; Albuquerque, NM, USA (6 Jun 1983).

The RAPIER "B Amplifier" electron beam system has been completed and produces 36kJ of 450KeV electrons in a 150ns pulse to be used for pumping a KrF laser amplifier. The operating characteristics of the system have been studied. The efficiency of conversion of energy stored in the Marx generator to electron beam output is 72 +- 3% including an 89% designed transfer efficiency. The system is triggered electrically with a 150ns delay from the command trigger to machine output. The rms jitter for the six individual modules range from 1.6 to 3.9ns and the average timing difference between the earliest and latest module is 12ns. Film dosimetry indicates no observable interaction between the magnetically isolated beams in the module diodes and fluorescence measurements do not indicate strong interaction in the gas filled laser cell. Current probe measurements show no significant change in beam size during the output pulse. Energy deposition profiles agree reasonably with Monte Carlo calculations up to pressures of 1.5 atm.

4204 Heat Transfer And Fluid Flow

REFER ALSO TO CITATION(S) 25671, 25696, 25829, 25860, 26797

25989 **(AD-A—163177/9/XAB) Failure analysis of a sodium, Inconel 617 heat pipe. Final report, June 1984-March 1985.** Jacobson, D.L.; Wang, J.H. (Arizona State Univ., Tempe (USA). Dept. of Mechanical and Aerospace Engineering). Sep 1985. 31p. NTIS, PC A03/MF A01.

A 4.57-meter (15-foot) sodium heat pipe, Inconel 617, was examined following failure. The sodium was exposed to the atmosphere following initial testing. Testing was resumed following attempts to reprocess the sodium by high-temperature outgassing. The pipe failed with intergranular cracks which completely penetrated the heat pipe wall leaking sodium to the atmosphere. Carbide precipitates and some grain boundary impurities were found in the cracked regions, which, along with the oxygen-contaminated sodium, embrittled the material. Thermal gradient-produced stresses during start-up coupled with embrittled grain boundaries appears to have resulted in the failure of the Inconel 617 sodium heat pipe.

25990 **(AD-A—163184/5/XAB) Failure analysis of a sodium heat pipe with integral lithium fluoride thermal energy storage. Final report, June 1984-March 1985.** Jacobson, D.L.; Soundararajan, P. (Arizona State Univ., Tempe (USA). Dept. of Mechanical and Aerospace Engineering). Sep 1985. 30p. NTIS, PC A03/MF A01.

A sodium, 321 stainless steel heat pipe with three filled Nb-1Zr tubes for thermal energy storage with 304 S.S. screen for wicking was thermal cycled to failure and then an analysis was performed to examine the failure. It was concluded that insufficient weld depth between an end cap and tube body permitted the propagation of a crack through a possible combination of thermal/corrosion failure, creep rupture of the end cap. A number of possible scenarios for the process following a leak are discussed.

25991 **(CONF-850254—3) Modeling of engine sprays. 1985 SAE Congress, Paper No. 850394.** Bracco, F.V. (Princeton Univ., NJ (USA). Dept. of Mechanical and Aerospace Engineering). 1985. Contract AC04-81AL16338. 24p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86008177.

From SAE international congress and exhibition; Detroit, MI, USA (27 Feb 1985).

Atomization and full-cone sprays from single cylindrical orifices are considered. The following subjects are reviewed: the structure of the breakup region; the structure of the far field; modern models that, given the outcome of the breakup process, compute the steady and transient of sprays; come comparisons with detailed measurements; and some practical applications. The following conclusions are reached: the spray breakup and the development regions are the most relevant in engine applications; the inner structure of the breakup region is still largely unknown; two- and three- dimensional spray models are available but remain mostly untested, particularly in their vaporization and combustion components, in part because of a lack of accurate measurements in controlled engine-type environments; engine applications of such models are, nonetheless, recommended for very valuable learning, interpretative, and exploratory studies, but not for predictions. 80 refs., 11 figs.

25992 **(CONF-860530—1) Some effects of vapor-liquid flow ratio on performance of a trickle-bed reactor.** Smith, C.M.; Satterfield, C.N. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Chemical Engineering). 1985. Contract FG22-83PC60798. 17p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86001256.

From 9. international symposium on chemical reaction engineering; Philadelphia, PA, USA (18 May 1986).

In the correlation of data from trickle-bed reactors results are frequently presented in terms of liquid hourly space velocities (LHSV) based on liquid feed to the reactor regardless of the extent to which the various components of the liquid may be vaporized within the reactor. This especially the case in petroleum and fuels processing where feed compositions are so complex chemically that a rudimentary kinetic expression frequently suffices. However in fact reactants and reaction intermediates of significant volatility will distribute themselves between the liquid and vapor phases. This distribution is affected not only by pressure and temperature, but also by the ratio of the flow rates of liquid and vapor and by liquid holdup in the reactor. This ratio and liquid holdup can thus affect reactant liquid concentrations in contact with the catalyst and hence conversion and selectivity. For a specified liquid hourly space velocity in a trickle bed reactor the degree of conversion of any reactant of appreciable volatility will usually descrease with increasing gas/liquid ratio. No effect will be observed with a true zero order reaction and the magnitude of the effect will be greater, the higher the order of reaction. For a reaction in equilibrium, here quinoline and PyTHQ, the equilibrium ratio can be affected by their relative volatilities which in turn can affect the rate of subsequent reactions. However the overall hydrodenitrogenation reaction of quinoline and N-containing organic intermediates is only marginally greater than zero order under the conditions studied and hence the percent HDN converison is little affected by gas-liquid ratio or vapor phase versus vapor-liquid reaction. 10 refs., 5 figs.

25993 **(DOE/ER/72012—T3) CALTECH - DOE program on numerical analysis, scientific computing and fundamental studies of motion, energy and mass transfer in fluids. Summary report No. 11, April 1, 1983-March 31, 1986.** (California Inst. of Tech., Pasadena (USA)). 1986. Contract AS03-76ER72012. 8p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86008369.

This report concerning the CALTECH-DOE program presents information on: vortex dynamics, turbulence and separated flows; flow in porous media and Hele-Shaw fingering; steady viscous flows with and without bifurcations; continuation methods; and boundary conditions on artificial boundaries. 33 refs.

25994 **(SAND—85-1520C) Wall layer models for the calculation of velocity and heat transfer in turbulent boundary layers.** Walker, J.D.A.; Scharnhorst, R.K.; Weigand, G.G. (Lehigh Univ., Bethlehem, PA (USA). Dept. of Mechanical Engineering and Mechanics; McDonnell Aircraft Co., St. Louis, MO (USA); Sandia National Labs., Albuquerque, NM (USA)). 1986. Contract AC04-76DP00789. 14p. (CONF-860130—4). American Institute of Aeronautics and Astronautics, 1290 Ave. of the Americas, New York, NY 10019. File Number TI86005884.

From 24. AIAA aerospace science meeting; Reno, NV, USA (6 Jan 1986).

In the computation of turbulent boundary-layer flows and internal flows, a substantial amount of mesh points and computational effort is required to adequately resolve the intense temperature and velocity profile variations in the near wall region. In this study, an-

alytical profile approximations are obtained for the mean velocity and temperature distribution in the wall layer; these profiles are based upon consideration of the observed coherent structure of the time-dependent wall-layer flow. The profile approximations are relatively simple analytical formulae which satisfy all the required compatibility conditions at the wall and the logarithmic behavior at the edge of the wall layer. The Reynolds analogy for heat transfer is not used in the present thoery. A general method for utilizing the present wall-layer profile models in a prediction method is indicated. 42 refs.

25995 **(SAND—85-2324C) Drag of bodies of revolution in cavitating flow.** Oberkampf, W.L.; Wolfe, W.P. (Sandia National Labs., Albuquerque, NM (USA)). 1986. Contract AC04-76DP00789. 10p. (CONF-860517—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86005171.

From 4. fluid mechanics, plasma dynamics and laser conference; Atlanta, GA, USA (12 May 1986).

The present paper describes work in progress concerning fluid dynamics of cavitating flow. The flow field and drag of bodies of revolution at zero angle of attack is predicted for cavity coefficients from fully-wetted flow to $\sigma = 0$. Excellent agreement for drag coefficient is demonstrated between theory and a water tunnel experiment. It is shown that skin friction drag is the dominant drag component for zero cavity coefficient. Excellent agreement is also demonstrated between theory and a high-speed water entry experiment. This agreement corroborates the experimental measurement that the cavity pressure is equal to the water vapor pressure, contrary to low-speed water entry. 14 refs.

25996 **(UCRL—93615) Simulating some statistical features of dusty gas turbulent flow.** Buckingham, A.C. (Lawrence Livermore National Lab., CA (USA)). 15 Nov 1985. Contract W-7405-ENG-48. 6p. (CONF-860517—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE86005774.

From 4. fluid mechanics, plasma dynamics and laser conference; Atlanta, GA, USA (12 May 1986).

This describes application of numerical simulations as extensions of turbulent flow experiments. These computations are designed to predict the interactive influences of solid dispersants on the turbulent continuous gas phase that entrains them. Interest derives from the view that these interactions may contribute significant modulating influence to turbulent phase constituent and molecular component evolution, reactive mixing, heat, and mass transfer in solid propellant combustion. The numerical simulation procedure utilizes spectral transform projection and spectral averaging collocation methods to represent the continuous phase Navier-Stokes equations. The continuous phase is iteratively matched at discrete time intervals to a random-walk Lagrangian statistical sampling procedure for the dispersed phase momenta and position expectancies. Ensemble averaging produces statistical velocity moments for both dispersed and continuous phases. 20 refs.

25997 **Dynamics of tubes in fluid with tube-baffle interaction.** Chen, S.S.; Jendrzejczyk, J.A.; Wambsgunss, M.W. (Argonne National Laboratory, Argonne, IL). *Journal of Pressure Vessel Technology;* 107: No. 1, 7-17(Feb 1985).

Three series of tests are performed to evaluate the effects of tube to tube-support-plate (TSP) clearance on tube dynamic characteristics and instability phenomena for tube arrays in crossflow. Test results show that, for relatively large clearances, tubes may possess "TSP-inactive modes" in which the tubes rattle inside some of the tube-support-plate holes, and that the natural frequencies of TSP-inactive modes are lower than those of "TSP-active modes," in which the support plates provide "knife-edge"-type support. Tube response characteristics associated with TSP-inactive modes are sensitive to tube-to-TSP clearance, TSP thickness, excitation amplitude, tube alignment, and the fluid inside the clearance. In addition, tube response is intrinsically nonlinear, with the dominance of TSP-inactive or TSP-active modes depending on the magnitudes of different system parameters. In general, such a system is difficult to model; only a full-scale test can provide all the necessary characteristics. A tube array supported by TSPs with relatively large clearances may be subjected to dynamic instability in some of the TSP-inactive modes; tube response characteristics and impact forces on TSPs for a tube row are studied in detail. Tube displacements associated with the instability of a TSP-inactive mode are small; however, impacts of the tube against TSPs may result in significant damage in a relatively short time.

4205 Materials Testing

REFER ALSO TO CITATION(S) 25613, 25664, 25826, 25955

25998 **(AD-A—162567/2/XAB) High sensitivity, one-sided x-ray inspection system. Final report, 20 November 1984-20 May 1985.** Cheng, Y.T.; Criscuolo, E.L. (Industrial Quality, Inc., Gaithersburg, MD (USA)). Jul 1985. 33p. (IQI-R—85-0710). NTIS, PC A03/MF A01.

A backscatter x-ray imaging method for nondestructive testing was developed. The one-sided inspection technique, a slot camera, is much faster in response than previous backscatter methods. Delaminations in graphite-epoxy composites and other low atomic number materials have been detected. Wall thicknesses up to 7 cm thick have been interrogated. The results show the location (depth) and magnitude (separation width) of simulated delaminations throughout the entire wall. A disbond between two flat surfaces in contact was detected. Feasibility of the system was shown with film detectors. A fast-response electronic detector is proposed. The objective of this program was to demonstrate the feasibility of an x-ray inspection equipment capable of probing an inspection sample from only one side to detect delaminations, voids, cracks or foreign material through the thickness interrogated. The feasibility of a unique, patented x-ray slot camera that works by scattered radiation was demonstrated using film techniques. The unique capability of this slot camera is that it can obtain images of the internal structure of an object at depths of many centimeters (depending on the object density and the x-ray energy) with a sensitivity that is several orders of magnitude greater than past-developed scattered radiation cameras.

25999 **(INIS-BR—438) Image quality - sensitivity of industrial X- and gamma- radiographs.** Kroenlein, C. (International Atomic Energy Agency, Vienna (Austria)). 1983. 12p. (CONF-8310416—3). NTIS (US Sales Only), PC A02/MF A01. File Number DE86701622.

From 1. Latin-American Congress and 4. national seminar of nondestructive testing; Sao Paulo, SP, Brazil (1 Oct 1983).

Discussed are industrial radiographs exposed by X- and gamma-rays and the sensitivities that are attainable with both sources of radiation on various material thicknesses.

26000 **(INIS-BR—439) Effect of the lead screen in the radiographic image using iridium 192 as a source.** Garate Rojas, M.; Serrano Sanchez, J. (International Atomic Energy Agency, Vienna (Austria)). 1983. 21p. (In Spanish). (CONF-8310416—4). NTIS (US Sales Only), PC A02/MF A01. File Number DE86701623.

From 1. Latin-American Congress and 4. national seminar of nondestructive testing; Sao Paulo, SP, Brazil (1 Oct 1983).

Presented is the effect of the lead screen in the image obtained on an impressionable film used in industrial gammagraphy. The source used was Iridium 192 and the tests were simulated like a real inspection.

26001 **(INIS-BR—440) Radiographic sensitivity evaluated by IQI DIN in double wall radiography and simple view.** Oliveira, C.S. de; Santos Filho, M. dos. (International Atomic Energy Agency, Vienna (Austria)). 1983. 14p. (In Portuguese). (CONF-8310416—5). NTIS (US Sales Only), PC A02/MF A01. File Number DE86701624.

From 1. Latin-American Congress and 4. national seminar of nondestructive testing; Sao Paulo, SP, Brazil (1 Oct 1983).

A comparison between the sensitivity of IQI-DIN put at the film side with the sensitivity of the IQI-DIN put at the source side, only for the double wall-simple view technique (DW-SW), is presented. An analysis about the requirements of radiographic sensitivity in accordance to DIN rule is done.

26002 (UCRL—92640) Computer modeling of tank track elastomers. Lesuer, D.R.; Goldberg, A.; Patt, J. (Lawrence Livermore National Lab., CA (USA); Army Tank-Automotive Command, Warren, MI (USA)). 1985. Contract W-7405-ENG-48. 20p. (CONF-8507113—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86008766.

From 32. Sagamore army materials research conference; Lake Luzerne, NY, USA (22 Jul 1985).

Computer models of the T142, T156 and the British Chieftain tank tracks have been studied as part of a program to examine the tank-track-pad failure problem. The modeling is based on the finite element method with two different models being used to evaluate the thermal and mechanical response of the tracks. Modeling has enabled us to evaluate the influence of track design, elastomer formulation and operating scenario on the response of the track. the results of these analyses have been evaluated with experimental tests that quantify the extent of damage development in elastomers and thus indicate the likelihood of pad failure due to "cutting and chunking." The primary characteristics influencing the temperatures achieved in the track are the heat-generation rate and the track geometry. The heat-generation rate is related to the viscoelastic material properties of the elastomer, track design and loading/operating scenario. For all designs and materials studied, stresses produced during contact with a flat roadway surface were not considered large enough to damage the pad. Operating scenarios were studied in which the track pad contacts rigid bars representing idealized obstacles in cross country terrain. A highly localized obstacle showed the possibility for subsurface mechanical damage to the track pad due to obstacle contact. Contact with a flat rigid bar produced higher tensile stresses that were near the damage thresholds for this material and thus capable of producing cutting and chunking failures.

4206 Safety Engineering

REFER ALSO TO CITATION(S) 25531

4208 Electronic Circuits And Devices

REFER ALSO TO CITATION(S) 25985, 25987, 26057, 26092, 26647

26003 (AD-A—163117/5/XAB) Heavy-ion-induced single-event upsets in a bipolar logic device. Technical report. Kolasinski, W.A.; Chenette, D.L. (Aerospace Corp., El Segundo, CA (USA). Space Sciences Lab.). 30 Dec 1985. 25p. (TR—0086(6940-05)-14). NTIS, PC A02/MF A01.

Heavy-ion test results for a bipolar logic device of moderate complexity are presented in this report. Such devices required the implementation of special techniques for testing circuits of varying upset sensitivity, and unlike similar MOS devices, present problems with test data interpretation.

26004 (NP—6901103) Determining the feasibility of using a microcomputer for electrical trouble-shooting on underground mining machinery. Final report for 1984-85 SOMED Project. Novak, T.; Webb, W.E.; Gupta, S.K. (Alabama Univ., University (USA)). 1985. 59p. SOMED, Box 6282, The University of Alabama, University, 5486. File Number TI86901103.

Faculty research report No. 73.

Breakdowns due to electrical component failure frequently occur with underground mining machines. These breakdowns interfere with normal production, while at the same time create potential safety hazards since repairmen must insert their hands into energized control-circuit areas to perform electrical trouble-shooting. Both the decreased productivity and safety problems associated with electrical breakdowns could possibly be reduced through using microcomputers for diagnosing electrical component failures. The time associated with trouble-shooting would be decreased, and repairmen would not have to make voltage measurements in crowded, energized control cases. The primary objective of this study was to develop a small-scale prototype of such a system. Electrical circuits for various underground mining machines were reviewed. Because of its relative simplicity, a motor-control circuit which is similar to that of a Lee Norse 45 continuous miner was selected and fabricated. The circuit was analyzed to determine how many test points were required for a microcomputer to predict which component has failed. A 64-k TSR-80 microcomputer was selected as the processing unit and was modified so that it could be interfaced with the test points of the motor-control circuit. An algorithm was developed to perform the diagnosis. Electrical faults were then simulated to verify the accuracy of the algorithm. The results showed that the microcomputer could accurately predict open-mode component failures. 16 figs.

26005 (SAND—85-1728C) Evaluation of extrinsic gettering techniques. Medernach, J.W.; Wells, V.A.; Witherspoon, L. (Sandia National Labs., Albuquerque, NM (USA); Sperry Univac, Eagan, MN (USA); KMI, Inc., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 6p. (CONF-860540—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE86003583.

From 169. meeting of the Electrochemical Society; Boston, MA, USA (4 May 1986).

Nitride (N-EG); poly-nitride (PN-EG), and poly (P-EG) extrinsic gettering techniques were evaluated using a 3.0 micron P-well CMOS process with N/N+ substrates. The devices used for this evaluation were a 2K SRAM and a N+ to P-well test diode. All gettering was applied as a post-opitaxial process except the P-EG material. Results showed that the N-EG material had lower defect surface densities and superior diode characteristics when compared to the P-EG and epitacial control Epi-C without gettering. Test diode characteristics showed the PN-EG and the N-EG samples having very low leakage currents compared to the P-EG and EPI-C samples. Similar findings also were obtained for the leakage current of the 2K SRAM. A graphical correlation between the leakage currents of the 2K SRAM and the test diode is established. This demonstrates how effective the N-EG and PN-EG gettering ability is for COMS processing. All devices receiving the nitride or the polynitride gettering showed improved device performance.

26006 (SAND—85-2259) Electronic simulator and calibrator for electrothermal response test systems. Moore, L.M.; Strasburg, A.C.; Spates, J.J. (Sandia National Labs., Albuquerque, NM (USA); Ktech Corp., Albuquerque, NM (USA)). Feb 1986. Contract AC04-76DP00789. 26p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86008874.

The electrochemical response (ETR) test is performed on electroexplosive devices (EED). A device is described which simulates these EED's. The simulator generates a voltage analog which varies exponentially with time and has an amplitude which is proportional to the third power of the input current. This exponential response is superimposed on a square wave analog which simulates the constant voltage drop across the cold resistance of a bridgewire. Also described is a calibrator for ETR testers. The calibrator generates a known change in resistance for determining the response of a system under test.

26007 (SAND—85-2420C) Measurement of internal capacitances of integrated circuits. White, K.; Palmer, D.; Hawkins, C.F.; Martin, G.L. (Sandia National Labs., Albuquerque, NM (USA); New Mexico Univ., Albuquerque (USA)). 1986. Contract AC04-76DP00789. 9p. (CONF-860566—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86006494.

From Electronic components conference; Seattle, WA, USA (5 May 1986).

Direct probe measurements have been made of intra-transistor and interconnection capacitances in integrated circuit CMOS technologies down to 2 μm detail. Resolution of measurements have been confirmed to 1 femtofarad. These differential capacitance measurements are taken at 1 MHz, comparable to the normal frequency range of circuit operation. These measurements are performed directly on structures normally occurring on integrated circuit wafers, not on special enhanced capacitive test keys or using custon on-chip amplifiers. The method used the HP-4062B semiconductor parameter extractor. Elaborate shielding and ac-guarding of adjacent microfeatures were necessary to measure only the capacitances of interest. Extensive signal averaging and system capacitance canceling was performed. Although elaborate and detailed,

the method developed can be used by any semiconductor production facility on their standard test structures. The voltage dependence of the junction capacitances of the drain to p-well and the gate to p-well were found consistent with calculation down to 2 μm dimensions. The gate to drain overlap capacitance was also examined allowing an estimate of the fringing contribution. 9 refs., 14 figs.

26008 **(UCRL—52000-85-12) Energy and Technology Review.** (Lawrence Livermore National Lab., CA (USA)). Dec 1985. Contract W-7405-ENG-48. 33p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86006995.

This report consists of three separate parts: Wafer-Scale Integration, Laser Pantography, and Generating Radar Images of the Earth with the S-1 Computer. The zone of Wafer-Scale Integration is to integrate the many complex digital logic and memory functions needed for a supercomputer all on a single 15 cm diameter silicon wafer. Laser pantography, in which a computer - steered and modulated laser beam directly deposits or removes material onto or from a substrate, is being developed for the rapid and efficient fabrication of integrated circuits. The development of a computer-processed radar image has provided images of higher resolution than is possible with the raw space radar. 21 refs., 15 figs., (WRF)

26009 **Gas flow stabilized megavolt spark gap for repetitive pulses.** Lawson, R.N.; O'Malley, M.W.; Rohwein, G.J. (to Dept. of Energy). US Patent 4,563,608. 7 Jan 1986. Filed date 8 Nov 1982. vp.

This patent describes a high voltage spark gap switch. It consists of a housing which has first and second end walls and a hollow first electrode which has a first outer surface and first annular opening located on the first end wall. Gas is supplied to the housing through the first annular opening. A second electrode has a second surface defining a second annular opening and receives gas from the first annular opening. It has a system for pumping the gas flowing within the housing, recirculating some of the gas flow through the housing and exhausting the remaining portion of pumped gas flow.

26010 **A rotating flux compressor for energy conversion.** Chowdhuri, P.; Linton, T.W.; Phillips, J.A. (Los Alamos National Lab., Los Alamos, NM). pp 661-664 of Fourth IEEE pulsed power conference. Rose, M.F.; Martin, T.H. New York, NY; Institution of Electrical and Electronics Engineers (1983). (CONF-830621—).

From IEEE power electronics specialists conference; Albuquerque, NM, USA (6 Jun 1983).

The rotating flux compressor (RFC) converts rotational kinetic energy into an electrical output pulse which would have higher energy than the electrical energy initially stored in the compressor. An RFC has been designed in which wedge-shaped rotor blades pass through the air gaps between successive turns of a solenoid, the stator. Magnetic flux is generated by pulsing the stator solenoids when the inductance is a maximum, i.e., when the flux fills the stator-solenoid volume. Connecting the solenoid across a load conserves the flux which is compressed within the small volume surrounding the stator periphery when the rotor blades cut into the free space between the stator plates, creating a minimum-inductance condition. The unique features of this design are: (1) no electrical connections (brushes) to the rotor; (2) no conventional windings; and (3) no maintenance. The device has been tested up to 5,000 rpm of rotor speed.

26011 **Basic studies of gases for diffuse-discharge switching applications.** Christophorou, L.G.; Hunter, S.R.; Carter, J.G.; Spyrou, S.M.; Lakdawala. (Atomic, Molecular and High Voltage Physics Group, Health and Safety Res. Div., Oak Ridge National Lab., Oak Ridge, TN). pp 702-708 of Fourth IEEE pulsed power conference. Rose, M.F.; Martin, T.H. New York, NY; Institution of Electrical and Electronics Engineers (1983). (CONF-830621—). Contract W-7405-ENG-26.

From IEEE power electronics specialists conference; Albuquerque, NM, USA (6 Jun 1983).

The basic processes which underlie the successful tailoring of gases with high dielectric strengths and appropriate conduction characteristics for diffuse-discharge switching applications are outlined. Recent results on electron attachment rate constants and cross sections as well as on the fragmentation by electron impact of CF_4, C_2F_6, C_3F_8, CF_3OCF_3, and CF_3SCF_3 which are of potential interest in diffuse-discharge technologies are presented. Recent findings on the electron attachment, electron drift velocity, and breakdown properties of a number of mixtures comprised of electron attaching and electron drift-velocity-enhancing components (e.g., C_3F_8/AR, C_2F_6/AR, C_2F_6/CH_4) are reported. The observed increase in the electron attachment rate constant of $CClF_3$ with temperature over a wide mean energy range ($\approx$0.5 to 4.0 eV) is reported and its implications for diffuse-discharge switching applications are indicated.

26012 **Experimental investigation of explosive-driven plasma compression opening switches.** Goforth, J.H.; Caird, R.S. (Los Alamos National Lab., Los Alamos, NM). pp 786-789 of Fourth IEEE pulsed power conference. Rose, M.F.; Martin, T.H. New York, NY; Institution of Electrical and Electronics Engineers (1983). (CONF-830621—).

From IEEE power electronics specialists conference; Albuquerque, NM, USA (6 Jun 1983).

Plasma compression opening switch techniques are being developed for use in explosive driven magnetic flux compression generator applications. A new test bed for performing low cost experimentation is described. Experiments with $\approx$0.15 MA/cm linear current density in the switch have achieved resistance increases of a factor of 10 in a few hundred nanoseconds. Peak field strengths of 30 kV/cm are generated in these tests. Data are presented from preliminary tests that indicate reduced pressure in the plasma cavity enhances switch performance.

26013 **Computational simulations of explosive driven plasma-quench opening switches.** Greene, A.E.; Brownell, J.H.; Oliphant, T.A.; Nickel, G.H.; Weiss, D.S. (Thermonuclear Applications Group, Applied Theoretical Physics Div., Los Alamos National Lab., Los Alamos, NM). pp 790-793 of Fourth IEEE pulsed power conference. Rose, M.F.; Martin, T.H. New York, NY; Institution of Electrical and Electronics Engineers (1983). (CONF-830621—). Contract W-7405-ENG-36.

From IEEE power electronics specialists conference; Albuquerque, NM, USA (6 Jun 1983).

High-explosive-driven plasma opening switches have been modeled in one dimension using the Lagrangian MHD code RAVEN. These calculations have been made in both cylindrical and planar geometry. Simple compression can account for observed resistance increases at early times (time-of-flight of the high-explosive detonation products across the plasma conducting channel). Our results suggest that some improvements in switch performance might be achieved through a judicious choice of gases in the plasma channel and by lowering the pressure in the channel.

26014 **Experimental investigation of an explosive-driven pulse power system.** Tucker, T.J.; Hanson, D.L.; Cnare, E.C. (Sandia National Lab., Albuquerque, NM). pp 794-797 of Fourth IEEE pulsed power conference. Rose, M.F.; Martin, T.H. New York, NY; Institution of Electrical and Electronics Engineers (1983). (CONF-830621—). Contract AC04-76DP00789.

From IEEE power electronics specialists conference; Albuquerque, NM, USA (6 Jun 1983).

The results obtained in the test of a pulse power system composed of a pulse power explosively driven compressed magnetic field current generator driving an explosive opening switch and a 20 nH inductive load are presented. It is shown that microsecond risetime, multimegampere current pulses can be produced by this technique.

4209 Waste Processing Plants And Equipment

REFER ALSO TO CITATION(S) 26242

26015 (GSF—16/85) Ecochemical aspects of waste management. Korte, F.; Bahadir, M.; Bieniek, D. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.)). Jun 1985. 71p. (In German). (GSF-OE—846). NTIS (US Sales Only), PC A04/MF A01. File Number DE86751459.

The existing waste treatment technologies do not offer a solution to the problem of waste disposal with a high amount of acceptability for man and environment. Some points for purposeful waste management for waste water treatment, cadmium treatment, solidification of industrial and hazardous wastes, treatment of persistent organic chemicals, waste disposal through incineration or pyrolyses, avoidance, reduction and recycling of waste are listed. (DG).

4210 Combustion Systems

REFER ALSO TO CITATION(S) 25318, 25764, 25765, 25766, 25768, 25809, 25817, 25823, 26173

26016 (CONF-860504—1) Effect of temperature and gas velocity distribution on the fluidization of the sticky particles. Arastoopour, H.; Gu, A.Z.; Weil, S.A. (Illinois Inst. of Tech., Chicago (USA); Institute of Gas Technology, Chicago, IL (USA)). May 1986. 9p. I.G.T., 3424 South State St., Chicago, IL 60616. File Number TI86900896.

From 5. international conference on fluidization; Elsinore, Denmark (18 May 1986).

We have constructed a 15 cm ID visually observable fluidized bed to obtain information about the fluidized bed under agglomerating conditions and study the effect of gas distribution and temperature variation on the rate and extent of agglomeration. The gas distributors consist of porous cones and a central jet. The temperature distribution and extent of agglomeration were measured at different operating conditions. Jet height, fluidizing air temperatures, and proper gas distribution can enhance the agglomeration of the sticky particles in the fluidized bed without causing detrimental sintering. 6 refs., 5 figs., 1 tab.

26017 (PB—86-115151/XAB) Co-firing of solid wastes and coal at Ames: stoker boilers. Hall, J.L.; Joensen, A.W.; Van Meter, D.; Even, J.C.; White, R.W. (Ames Dept. of Public Works, IA (USA)). Sep 1985. 203p. NTIS, PC A10/MF A01.

The report presents an evaluation of the Ames Solid Waste Recovery System through the second full year of its operation (1977). This evaluation includes the operating experience and economics of the refuse processing plant, the characterization of the various material flow streams within the refuse processing plant, and the thermodynamic and mechanical performance and the environmental emissions of the stoker-fired steam generators.

26018 (STF—15A85002) Development of small wood-burning stoves/fireplaces. Karlsvik, E. (SINTEF, Trondheim (Norway)). Jan 1985. 19p. (In Norwegian). NTIS (US Sales Only), PC A02/MF A01. File Number DE86751554.

The report deals with a project on the development of new and efficient wood-burning stoves/fireplaces. 4 prototypes are tested, and the following results are obtained: - Efficient combustion of flue gases. - Efficiency of about 90%. - Flue gas temperature from 130 to 160 deg. C at the inlet of the stove pipe. - Stoking interval varies from 4 to 12 hours depending on fast and slow combustion. - Improved efficiency of 7-14% by means of the heat exchanger, and depending on slow and fast combustion. 6 drawings.

26019 (STF—15A85007) Condition monitoring of a bark-fired boiler. Berg, S.; Loeken, P.A. (SINTEF, Trondheim (Norway)). Jan 1985. 38p. (In Norwegian). NTIS (US Sales Only), PC A03/MF A01. File Number DE86751558.

The report deals with the recording of deposited matters on heating surfaces of an operating bark-fired boiler. The deposited matters effect the efficiency of the boiler, and therefore the heating surfaces are to be cleaned by steam every 8 hours. The volume of steam used in this process increases the cost of production. A computer program is developed to monitor the deposited matters. The obtained data show that the thickness of matter increases faster near to the outlet of the combustion chamber than on the other surfaces concerned. The computer program will be an useful tool in organizing the cleaning routines. 11 drawings, 3 tables.

26020 Tube support grid and spacer therefor. Ringsmuth, R.J.; Kaufman, J.S. (to Dept. of Energy). US Patent 4,570,703. 18 Feb 1986. Filed date 8 Feb 1982. vp.

This patent describes a tube support grid for supporting and spacing heat exchanger tubes within a heat exchanger. The heat exchanger is characterized by expected temperature ranges according to location within the heat exchanger. Each heat exchange tube has both a coolant inlet and a coolant outlet adjacent to its base and is welded at the base to a tube sheet and extends generally upward therefrom. The heat exchanger has a predetermined location a predetermined distance above the tube sheet for the tube support grid. The tubes are arranged on a circular array with a predetermined number of circular rows. The bases of the tubes are arranged in a similar array, the radial and circumferential pitches vary within known limits according to the temperature of the tube sheet.

26021 (BGC/MRS/M—14965) Design and dimensioning of industrial burners, Part 2. Fritsch, W.H. Translated from *Gas Waerme International ;* **32**: No. 6, 257-263(Jan 1983). 18p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86900484.

This report presents information on: recuperator burners; radiant heating tubes; direct-acting hot gas generators; indirect heating; and the industrial furnace burner as partner in chemical reactions for the purpose of design and dimensioning of industrial burners. 11 refs., 31 figs.

4230 Marine Engineering

26022 (AUC-IBT—8504) Development of applicable methods for evaluating the safety of offshore structures. Pt. 2. Soerenen, J.D.; Toft-Christensen, P.; Sigurdsson, G. (Aalborg Universitetscenter (Denmark). Inst. for Bygningsteknik). May 1985. 35p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86751516.

The research project "Development of applicable methods for evaluating the safety of offshore structures" was initiated in August 1984. The present paper describes progress made during the first four months of 1985. A new program package called MEKBETA is described. By this program fundamental mechanisms can be identified automatically. Also significant mechanisms in plane and space frame and lattice structures are identified automatically. Finally, the reliability of the structural system is estimated on the basis of the identified significant mechanisms. The automatic generation of fundamental mechanisms is based on the method suggested by Watwood. The computer program MEKBETA has been on three simple examples.

26023 (NHL—284007) Local erosion at marine structures. A field study by a structural model. Mathiesen, B.; Tesaker, E. (Norges Hydrodynamiske Lab., Trondheim). Dec 1983. 105p. (In Norwegian). NTIS (US Sales Only), PC A06/MF A01. File Number DE86751555.

A scaled down test to probe the sea-bed condition by means of a cylindrical structure with a diameter and height of 5 m was placed on the sea bed at Grande Viken to the west of Oerlandet (Norway). The average water depth was about 4.5 m. In the period from october 1977 to April 1980, the structure was positioned on 3 different places. In every one of them, the change of the sea bed conditions near to the cylinder were closely observed, and at the same time the current and wave conditions were recorded. The report deals with the measuring results, and also a mathematical model which relates the recorded erosion depths to the calculated shearing stresses of the sea bed. 73 drawings, 5 tables.

26024 (NHL—284008) Local erosion at marine structures. Appendices. Mathiesen, B.; Tesaker, E. (Norges Hydrodynamiske Lab., Trondheim). Dec 1983. 211p. (In Norwegian). NTIS (US Sales Only), PC A10. File Number DE86751556.

26025 (VTT-TIED—298) Geotechnics of fixed offshore drilling platforms. Toernqvist, J. (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)). Mar 1984. 171p. (In Finnish). NTIS (US Sales Only), PC A08/MF A01. File Number DE86751568.

Fixed offshore-structures are widely used for exploration and exploitation of undersea oil and gas resources. The object of this report is to survey the general geotechnical design principles and foundation technics of fixed offshore-structures. Additionally, it is attempted to give an overall view of such environmental conditions which have influence on the geotechnical design. Because of the many types of structures surveyed and variations in environmental conditions, detailed design methods are given only in a few cases. This report deals with pile-supported jacket platforms, jack-up-platforms on mat or on separate footings, concrete gravity platforms and man-made islands. The main emphasis has been laid on pile-supported jacket-structures and gravity structures. Different pile types and installation methods used in jacket-structures are presented. Common pile design principles have been surveyed. Load-displacement-relationships used in design of laterally loaded piles have been discussed in detail both for static and cyclic loads. Geotechnical problems in installation of gravity structures have been discussed widely. The principles of a simple method used for stability calculations have been shown. Also a simple graphic method for establishing the deformation properties of soil in storm loading is shown.

4240 Pollution Control Equipment

26026 (STEV-FBA—85-34) NOsub(x) reduction technology in Japan. Kurihara, K. (Statens Energiverk, Stockholm (Sweden)). Jun 1985. 61p. NTIS (US Sales Only), PC A04/MF A01. File Number DE86751545.

Ambient air quality standards are a policy goal, formulated pursuant to the provision of Pragraph 1, article 9 of the Basic Law for Environmental Pollution Control. As of January 1985, ambient air quality standards are set for sulfur dioxide (SO_2), carbon monoxide (CO), suspended particle matter (SPM), nitrogen dioxide (NO_2), and photochemical oxidants (Ox). Control measures for NOsub(x) emitted fro soot and smoke emitting facilities are: 1 Law NOsub(x) combustion technique such as improvement of combustion conditions and combustion techniques. 2 Conversion of fuels. Fuel NOsub(x) produced by nitrogenous compounds in fuel can be controlled by using lighter fuels. 3 Densification of flue gas. Dry and wet processes are available. The total number of denitrifications units was 188 in January 1983. 143 used selective catalytic reduction process, 26 non-catalytic reduction process, 1 dry absorption process, 14 wet absorption process, 3 wet reduction process, and 1 used some other form of dentification process.

26027 (SVF—158) Continuous measurement of emissions. Instrumentation from operational and environmental points of view. Hjalmarsson, A.K. (Stiftelsen foer Vaermeteknisk Forskning, Stockholm (Sweden)). Jun 1984. 61p. (In Swedish). NTIS (US Sales Only), PC A04/MF A01. File Number DE86751535.

The necessity to control the process and the emissions from solid fuel-fired boilers through monitors is increasing with increasing automatization of new plants. To have an efficient control of the process and emissions, it is necessary to have on-line monitors with high availability and reliability. Both the O_2 and the CO contents in the flue gas ought to be monitored to control the operation of the boiler and to get good process economy. To conttrol the emission, usually SO_2, NOsub(x) and dust contents in the flue gas are of interest. In-situ monitors have been developed due to the problems associated with extractive monitoring systems. It is the sampling systems in the extractive systems that cause the problems. Data recording from monitors should be done through a simple data logger or an information data system to enable continuous calculations of emissions in a computor. A check of the quality of the values from the monitors, if they seem to be true, can also be done in the computor system. To be able to calculate the emissions that are required from the authorities (in the units g S/MJ input fuel, g NO_2/MJ or mg dust/MJ) it is necessary to have more information from the process than the content of emissions in the flue gas, such as for example the flue gas flow, the flow of the fuel, the heat value of the fuel. The calculations can be done in several ways, starting from different measured values. The calculations of emission, in the unit g/MJ input fuel, can either be done as of an ordinary mean value or of a 'weighed mean value'. In the calculation of the 'weighed mean value' the value is related to the load and the 'weighed mean value' in the value that ought to be reported.

43 PARTICLE ACCELERATORS

4301 Design, Development, And Operation

26028 (KEK—84-5) KEK NODAL user's guide. Akiyama, Atsuyoshi; Katoh, Tadahiko; Kikutani, Eiji; Koiso, Haruyo; Kurokawa, Shin-ichi; Oide, Katsunobu. (National Lab. for High Energy Physics, Oho, Ibaraki (Japan)). Jun 1984. 55p. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. File Number DE86701642.

NODAL is an interpreter language for accelerator control developed at CERN SPS and has been used successfully since 1974. At present NODAL or NODAL-like languages are used at DESY PETRA and CERN CPS. At KEK, we have also adopted NODAL for the control of TRISTAN, a 30 GeV x 30 GeV electron-positron colliding beam facility. The KEK version of NODAL has the following improvements on the SPS NODAL: (1) the fast execution speed due to the compiler-interpreter scheme, and (2) the full-screen editing facility. This manual explains how to use the KEK NODAL. It is based on the manual of the SPS NODAL, The NODAL System for the SPS, by M.C. Crowley-Milling and G.C. Shering, CERN 78-07. We have made some additions and modifications to make the manual more appropriate for the KEK NODAL system, paying attention to retaining the good features of the original SPS NODAL manual. We acknowledge Professor M.C. Crowley-Milling, Dr. G.C. Shering and CERN for their kind permission for this modification.

26029 (NP—6900837) European Organization for Nuclear Research, annual report, 1972. (European Organization for Nuclear Research, Geneva (Switzerland)). 1973. 222p. European Organization for Nuclear Research, Geneva, Switzerland. File Number TI86900837.

Information is provided on the research programs conducted at CERN during 1972.

26030 Superconductors for pulsed RF accelerators. Campisi, I.E.; Farkas, Z.D. (Stanford Linear Accelerator Center, Stanford University, Stanford, CA). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-32**: No. 5, 3602-3604(Oct 1985). (CONF-850504—).

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

The choice of superconducting materials for accelerator RF cavities has been determined in the past only in part by basic properties of the superconductors, such as the critical field, and to a larger extent by criteria which include fabrication processes, surface conditions, heat transfer capabilities and so on. For CW operated cavities the trend has been toward choosing materials with higher critical temperatures and lower surface resistance, from Lead to Niobium, from Niobium to Nb_3Sn. This trend has been dictated by the specific needs of storage ring CW system and by the relatively low fields which could be reached without breakdown. The work performed at SLAC on superconducting cavities using microsecond long high power RF pulses has shown that in Pb, Nb, and Nb_3Sn fields close to the critical magnetic fields can be reached without magnetic breakdown. The major results of the tests on the three technical superconductors are illustrated. From these measurements comes the demonstration that for sufficiently short pulses

there is no specifically predetermined critical field, and it is possible to exceed, depending on the material, even the superheated critical field.

26031 Electron emission of over 200 A/CM² from a pulsed-laser irradiated photocathode. Lee, C.H.; Fraser, J.S.; Jacob, J.H.; Klinkowstein, R.; Oettinger, P.E.; Pugh, E.R.; Sheffield, R.L. (Thermo Electron Corporation, Waltham, MA). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-32: No. 5, 3045-3047(Oct 1985). (CONF-850504—).

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

High-current-density, bunched electron beams with low emittance are required for efficient operation of rf-linac-driven free-electron lasers (FELs). Laserirradiated, photoemissive electron sources are suitable for this application. Currents of over 200 A have been generated in an ultrahigh vacuum chamber from a 1-cm² Cs_3Sb photocathode irradiated by a frequency-doubled, Q-switched pulse from a Nd:glass laser. These currents are over two times larger than previously reported from any photocathode. The duration of the electron pulse was 50 ns (FWHM), corresponding to the width of the 532-nm laser pulse.

26032 Technology of magnetically driven accelerators. Brix, D.L.; Hawkins, S.A.; Poor, S.E.; Reginato, L.L.; Smith, M.W. (Lawrence Livermore National Laboratory, Livermore, CA). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-32: No. 5, 2743-2747(Oct 1985). (CONF-850504—).

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

The marriage of Induction Linac technology with Nonlinear Magnetic Modulators has produced some unique capabilities. It appears possible to produce electron beams with average currents measured in amperes, at gradients exceeding 1 MeV/meter, and with power efficiencies approaching 50%. A 2 MeV, 5 kA electron accelerator has been constructed at the Lawrence Livermore National Laboratory (LLNL) to demonstrate these concepts and to provide a test facility for high brightness sources. The pulse drive for the accelerator is based on state-of-the-art magnetic pulse compressors with very high peak power capability, repetition rates exceeding a kilohertz and excellent reliability.

26033 Mechanical considerations in CW linacs. King, J.D. (Los Alamos National Laboratory, Los Alamos, NM). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-32: No. 5, 2730-2732(Oct 1985). (CONF-850504—).

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

An 80-MHz radio-frequency quadrupole (RFQ) linac has been designed, fabricated and operated at 100% duty factor (cw) for the Fusion Materials Irradiation Test (FMIT) project at Los Alamos. This paper describes the design features, fabrication techniques, and operational problems of the device. The RFQ is an assembly of heavy steel, copper-plated weldments. It measures about 15 ft (4.5 m) long by 5 ft (1.5 m) in diameter and weighs over 12 t. Major components are two pair of diametrically orthogonal vanes mounted in a core cylinder. The core is assembled into a manifold cylinder that couples rf power into the vane quadrants. The design features discussed include assembly of hollow wall, flood-cooled components; highconductivity rf seals; removable and adjustable vanes; and tuning devices. Fabrication challenges such as close-tolerance weldments, vane-tip-contour machining and large-component plating requirements are covered.

26034 Pump depletion and laser staging for beat-wave accelerator. Tajima, T.; Horton, W.; Singer, S.; Witte, K. (Institute for Fusion Studies, The University of Texas at Austin, Austin, TX). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-32: No. 5, 3542-3544(Oct 1985). (CONF-850504—).

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

The beat-wave accelerator (BWA) scheme is promising for a large acceleration gradient for high energies. Some of the concerns with this accelerator concept are the longitudinal dephasing between the speed of high energy particles and that of plasmons and the laser pump depletion. The latter problem is analyzed in detail here. To cope with these problems and also to ease some of the requirements on laser and plasma parameters, we propose an accelerator architecture for BWA with the following features: distributed laser staging optically connected by the master oscillator; optical delay lines synchronizing the timing and phase of each laser stage; appropriate mirror systems; and optical guides (plasma fiber) to trap laser beams by acoustic transducers or other mechanism. If necessary, additional collector devices may be added to collect any unused portion of laser power and to convert it for reuse.

26035 Effect of Cu_4Ti compound formation on the characteristics of NbTi accelerator magnet wire. Garber, M.; Sabatini, R.L.; Sampson, W.B.; Suenaga, M. (Brookhaven National Laboratory, Upton, NY). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-32: No. 5, 3681-3683(Oct 1985). (CONF-850504—).

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

High critical current density, J /SUB c/ > 2500 A/mm², and small filament diameter, d about 3 μm, are required in multifilamentary NbTi wire used for superconducting accelerator magnets. Wires obtained from various commercial sources had J /SUB c/ 's in the range 1000 to 2800 A/mm² and d's in the range 1 to 23 μm. The filaments were examined by means of scanning electron microscopy in order to determine the reason for the variation in J / SUB c/ . It was found that the filaments in high J /SUB c/ wires had clean smooth surfaces and uniform cross section along their lengths. Filaments in low J /SUB c/ wires show formation of Cu_4Ti compound particles on their surfaces and large variations in cross section. The lower critical current measured in these wires is believed to be largely due to this effect. The superconducting-normal state transition is relatively wide in these wires.

26036 Magnetization, critical current, and injection field harmonics in superconducting accelerator magnets. Ghosh, A.K.; Sampson, W.B.; Wanderer, P. (Brookhaven National Laboratory, Upton, NY). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-32: No. 5, 3684-3686(Oct 1985). (CONF-850504—).

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

The very large energy ratio of machines such as the SSC dictates rather low injection field (for 6T, 20 TeV it is approximately 0.3T). Since the harmonic content at such low fields is largely determined by magnetization currents in the superconductor, the random errors depend on the uniformity of the superconducting wire. In principle the magnitude of the residual fields can be reduced indefinitely by using finer filaments, but in practice there is a lower limit of a few microns. We have compared the injection field harmonics for a number of accelerator dipoles with magnetization measurements made on samples of the conductor used to wind the coils. In addition both the magnetization and harmonics have been compared with short sample critical current measurements made at 5T. The results indicated that an accurate estimate of the variation in injection field harmonics can only be obtained from direct measurements of the magnetization of the cable. It appears feasible to use such measurements to "shuffle" magnets for a large accelerator by predicting the low field properties of a magnet before actually winding the coils.

26037 Large electrostatic accelerators. Jones, C.M. (Oak Ridge National Laboratory, Oak Ridge, Tennessee). pp 496-503 of Tenth international conference on cyclotrons and their applications. Marti, F. New York, NY; Institution of Electrical and Electronics Engineers (1984). (CONF-8404143—).

From 10. international conference on cyclotrons and their applications; East Lansing, MI, USA (30 Apr 1984).

The paper is divided into four parts: a discussion of the motivation for the construction of large electrostatic accelerators, a description and discussion of several large electrostatic accelerators which have been recently completed or are under construction, a description of several recent innovations which may be expected to

improve the performance of large electrostatic accelerators in the future, and a description of an innovative new large electrostatic accelerator whose construction is scheduled to begin next year.

26038 Tenth international conference on cyclotrons and their applications. Marti, F. (ed.). New York, NY; Institute of Electrical and Electronics Engineers, Inc. (1984). 778p. (CONF-8404143—). IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854. File Number TI85013505.

From 10. international conference on cyclotrons and their applications; East Lansing, MI, USA (30 Apr 1984).

Papers were presented on the topics of: newly operating accelerators; accelerator theory, magnets, injections, sources, extraction, and cryogenics; facilities in construction; radio frequency systems; controls, beam lines and targets; competing technologies; vacuum systems; stripping; cooling rings; and advanced concepts. Besides papers, there is a list of cyclotrons and synchrocyclotrons, and data sheets on cyclotrons around the world. Separate abstracts were prepared for 119 papers in this conference proceedings. Another 23 papers had been previously abstracted for EDB. (LEW)

4302 Beam Dynamics, Field Calculations, And Ion Optics

REFER ALSO TO CITATION(S) 25975, 26067, 26084

26039 (AD-A—162418/8/XAB) Stochasticity of particle orbits in a collective particle accelerator. Memorandum report, September 1984-September 1985. Ganguli, G.; Mitchell, H.G.; Palmadesso, P.J. (Naval Research Lab., Washington, DC (USA)). 6 Dec 1985. 24p. (NRL-MR—5664). NTIS, PC A02/MF A01.

A detailed investigation of the behavior of particle orbits in the simultaneous presence of three large amplitude waves such as those encountered in the Collective Particle Accelerator (CPA) experiment is undertaken. Stochasticity arising out of the resonance overlap of the waves can influence the particle dynamics significantly and thereby affect the outcome of the experimental results. Choice of initial phase and energy for successful operation is identified and discussed.

26040 (AD-A—162791/8/XAB) High-repetition-rate electron-beam rf acceleration and submillimeter-wave generation via a free electron laser. Annual progress report, 15 August 1984-14 August 1985. Luhmann, N.C.; McDermott, D.B. (California Univ., Los Angeles (USA). School of Engineering and Applied Science). 14 Aug 1985. 22p. NTIS, PC A02/MF A01.

An r-f linac was constructed which is specifically designed for free-electron-laser applications. The shunt resistance is moderate, thereby allowing the acceleration of relatively high-beam currents (somewhat 1 A) which will result in moderate FEL gains (somewhat 10 dB). Numerical simulation of the single-cavity TM/ sub 010/ linear accelerator was performed to determine the optimum cavity length. For this value, optimally phased electrons cross the cavity in one half of the rf cycle. This length is dependent on both the input and desired output energies. For the calculations, 10 kV was chosen as the input electron energy and 725 kV as the output energy in order to amplify 94-GHz radiation with a 3.0-cm period wiggler.

26041 (AD-A—163206/6/XAB) Electromagnetic instability in a quadrupole-focus accelerator. Hughes, T.P.; Godfrey, B.B. (Mission Research Corp., Albuquerque, NM (USA)). Oct 1985. 27p. (AMRC-R—323). NTIS, PC A03/MF A01.

The addition of helical focusing to a modified betatron configuration is shown to give rise to an electromagnetic instability under certain conditions. The instability arises from a three-wave coupling between the helical field, a transverse mode on the beam, and a transverse-electric waveguide mode. An analytic dispersion relation is derived. Several features of the instability are confirmed using three-dimensional computer simulations.

26042 (AD-A—163207/4/XAB) Estimates of negative-mass instability growth for the NRL betatron. Hughes, T.P. (Mission Research Corp., Albuquerque, NM (USA)). Dec 1985. 19p. (AMRC-R—327). NTIS, PC A02/MF A01.

Growth rates of the negative-mass instability are calculated for parameters close to those of the NRL betatron. The results indicate that the negative-mass transition energy is at or close to, the injection energy. In the absence of a spread in particle circulation frequencies, strong negative-mass growth is predicted to set in as the beam is accelerated. To avoid this, it may be necessary to significantly increase the beam minor radius. A stability criterion in terms of the minor radius is given.

26043 (FNAL-TM—1383) Microwave stability limits for the main ring and growth across transition. Ng, K.Y. (Fermi National Accelerator Lab., Batavia, IL (USA)). Jan 1986. Contract AC02-76CH03000. 22p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86008120.

The purpose of this paper is to estimate the phase space blowup across transition and give critical absolute value of Z/n limits at each stage of performance. It turns out that the most stringent limit is absolute value of Z/n $\sim$1.3 Ω which occurs during the RF manipulation of the proton bunches at 120 GeV in preparation of anti p production.

26044 (FNAL-TM—1385) Single bunch instabilities of the RHIC booster. Ng, K.Y. (Fermi National Accelerator Lab., Batavia, IL (USA)). Feb 1986. Contract AC02-76CH03000. 19p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86008123.

In this paper, we try to estimate the stability limits and impedances of the Brookhaven RHIC booster. Some important data on the booster are shown. From the stability limits and impedances, it is clear that the booster is safe against either fast microwave instabilities or slow mode-colliding single bunch instabilities. 4 figs., 5 tabs.

26045 (FNAL-TM—1388) Estimate of the longitudinal and transverse impedances of the main ring in the TeV I project. Ng, K.Y. (Fermi National Accelerator Lab., Batavia, IL (USA)). Feb 1986. Contract AC02-76CH03000. 26p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86008122.

To guarantee the successful performance of the Main Ring in Tevatron I, its stability limits and impedances have to be estimated and controlled. The impedances of the Main Ring are estimated, considering contributions from the bellows, beam position monitors, wall resistivity, kickers and Lambertsons. The estimations of the contributions to the longitudinal and transverse impedances are tabulated and plotted. The stability limits for the worst situation are also tabulated for comparison. The slow-growing single bunch instability caused by longitudinal mode coupling is found to be safe. The corresponding instability caused by transverse mode coupling is not. The fast-growing longitudinal microwave instability is found to be driven by the sharp resonances of the bellows and beam monitors and may be the broad resonances of the Lambertsons also. The fast-growing transverse microwave instability is found to be safe. It is found that, to have stability, the bellows have to be shielded and the beam monitors terminated at the ends instead of the center. The slow-growing transverse mode coupling is found to be curable by feedback. 6 tabs., 7 figs. (LEW)

26046 (FNAL-TM—1389) Measurement of the main ring longitudinal impedance by debunching. Ng, K.Y. (Fermi National Accelerator Lab., Batavia, IL (USA)). Feb 1986. Contract AC02-76CH03000. 28p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86009135.

An experiment was carried out to observe microwave signals of the bunched beam in the Fermilab Main Ring. The purpose of this paper is to analyze the experiment and attempt a computation of the longitudinal impedance per unit harmonic Z/n of the Main Ring. The result of the analysis indicates Z/n = 8.6 Ω if the driving impedance is a broad band at f/sub MW/ = 1.646 GHz. However, if the driving impedance is a high-Q resonance at 1.646 GHz with RMS width less than $\sim$0.13 GHz (or Q $\sim$ 50), Z/sub sh//Q

of the resonance is 5.2 kΩ. We demonstrate that the proton bunches are of Gaussian shape. The time at which the microwave amplitude starts to grow is determined. We find that this occurs when two adjacent bunches overlap each other. A stability criterion is derived for the overlapped bunches. Then Z/n and Z/sub sh//Q are computed. The source of the driving impedance is traced.

26047 **(GSI—85-18) Thin-walled beam tubes for the SIS. Construction and manufacturing.** Malwitz, E. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). Jun 1985. 32p. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number DE86751091.

The vacuum system of the SIS consists essentially of torus-shaped vacuum chamber with an annulus-circumference of 216 m which is composed by several beam-tube and chamber elements. In order to reach the desired final pressure of $<= 5 . 10^{11}$ mbar ($5 . 10^{9}$ Pa) a heating of the whole vacuum system to 300°C is required. The beam tubes within magnets have regularly an elliptic tube cross section. Within bending magnets the beam tubes are curved in a plane through the large ellipse axis with a bending radius of 10 m. During the development work for the beam tubes within magnets to construction variants were studied until construction maturity. Generally thin-walled beam tubes with elliptic tube cross section are fabricated similarly to spring bellows as corrugated tubes. In this report however beam tubes with elliptic tube cross section are discussed the tube walls of which are smooth and stabilized against the atmospheric pressure by hard-soldered ribs. The report reproduces mainly the most important know how respectively serves as instruction for new constructions. Such beam tubes are planned for the dipole magnets and the quadrupole group consisting of two long quadrupoles, a short quadrupole, and a sextupole. (orig./HSI).

26048 **(LBL—18987-Rev.) Nonlinear dynamics. A personal perspective.** Laslett, L.J. (Lawrence Berkeley Lab., CA (USA)). Dec 1984. Contract AC03-76SF00098. 91p. (CONF-850114—7-Rev.). NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE86008376.

From Joint US/CERN School on Particle Accelerators topical course on non-linear dynamics; Sardinia, Italy (31 Jan 1985).

Development of stochasticity from area-preserving canonical transformations is discussed. Examples are given of limiting (resonant) frequencies for particle motion in the median plane of a strong-focusing ring. Bifurcation is illustrated for area-preserving transformations and solutions to differential equations. (LEW)

26049 **(SAND—85-2670) Electron beam linac simulations, 1985.** Poukey, J.W. (Sandia National Labs., Albuquerque, NM (USA)). Feb 1986. Contract AC04-76DP00789. 83p. NTIS, PC A05/MF A01; GPO Dep. File Number DE86008313.

The results of particle simulation studies of electron beam problems for the year 1985 are summarized. Although the main subjects this year were mostly the same as in previous years, namely foilless diodes, accelerating gaps, and beam extraction, a major new element this year was the addition of IFR (ion-focused-regime) channels to the various components of a linac beam line. Of particular interest may be the new results obtained for IFR autoacceleration gaps (relevant to MIMI), and the studies of extraction from a guide magnetic field onto an IFR propagation channel (relevant to RADLAC II). 49 figs., 20 refs.

26050 **(SLAC/AP—49) Chirped accelerator.** Lippmann, B.A. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Feb 1986. Contract AC03-76SF00515. 2p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86008510.

26051 **(TRI-PP—85-79) Permanent magnet quadrupole design with iron yoke and low harmonic content.** De Vita, E.; Otter, A.J.; Thomas, B. (TRIUMF, Vancouver, British Columbia (Canada)). Sep 1985. 4p. (CONF-850920—11). NTIS (US Sales Only), PC A02/MF A01. File Number DE86900762.

From 9. international conference on magnet technology; Zurich, Switzerland (9 Sep 1985).

We present the results of a study using the POISSON codes to investigate the design of a permanent magnet quadrupole with an outer iron yoke. The magnet dimensions were expressed as ratios of the semi-aperture and varied to investigate the minima of the sixth and tenth harmonic content at 90% bore. The two minima cannot be achieved with a single geometry. We achieved a profile with predicted values of 0.04% sixth and 0.05% tenth harmonic. The strength of the quadrupole is varied by changing the thickness of the permanent magnet material and this does not affect the harmonics. A comparison of calculated harmonics and those measured for a commercially purchased magnet with no iron is given. Also a comparison of the cross section of permanent magnet material required for designs with and without iron is presented.

26052 **Initial measurements of beam breakup instability in the advanced test accelerator.** Chong, Y.P.; Caporaso, G.T.; Struve, K.W. (Lawrence Livermore National Laboratory, Livermore, CA). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-32: No. 5, 3210-3212(Oct 1985). (CONF-850504—).

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

This paper reports the measurements of beam breakup (BBU) instability performed on the Advanced Test Accelerator (ATA) up to the end of February 1984. The main objective was to produce a high current usable electron beam at the ATA output. A well-known instability is BBU which arises from the accelerator cavity modes interacting with the electron beam. The dominant mode is TM130 at a frequency of approximately 785 MHz. It couples most strongly to the beam motion and has been observed to grow in the Experimental Test Accelerator (ETA), which has only eight accelerator cavities. ATA has one hundred and seventy cavities and therefore the growth of BBU is expected to be more severe. In this paper, BBU measurements are reported for ATA with beam currents of 4 to 7 kA. Analysis showed that the growth of the instability with propagation distance was as expected for the lower currents. However, the high current data showed an apparent higher growth rate than expected. An explanation for this anomaly is given in terms of a "corkscrew" excitation. The injector BBU noise level for a field emission brush cathode was found to be an order of magnitude lower than for a cold plasma discharge cathode. These injector rf amplitudes agree very well with values obtained using the method of differenced $B\theta$ loops.

26053 **Measurement and interpretation of electron angle at mabe beam stop.** Sanford, T.W.L.; Coleman, P.D.; Poukey, J.W. (Sandia National Laboratories, Albuquerque, NM). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-32: No. 5, 3271-3273(Oct 1985). (CONF-850504—).

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

This analysis shows that radiation measurements combined with a sophisticated simulation provides a simple but powerful tool for estimating beam temperature in intense pulsed annular electron-beam accelerators. Specifically, the mean angle of incidence of a 60 kA, 7 MeV annular electron-beam at the beam stop of the MABE accelerator and the transverse beam temperature are determined. The angle is extracted by comparing dose profiles measured downstream of the stop with that expected from a simulation of the electron/photon transport in the stop. By calculating and removing the effect on the trajectories due to the change in electric field near the stop, the beam temperature is determined. Such measurements help give insight to beam generation and propagation within the accelerator.

26054 **Moments in particle-in-cell simulations.** Berz, M.M.; Lysenko, W.P. (Los Alamos National Laboratory, Los Alamos, NM). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-32: No. 5, 2559-2561(Oct 1985). (CONF-850504—).

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

The moment equations that form the basis of the BEDLAM simulation code can also be used as a check on Particle-In-Cell (PIC) simulations. Moments can be computed as sums over the macroparticles used in the PIC simulations. These moments should satisfy the moment equations if the simulation is valid. A check has

been done to sixth order for two cases: the RFQRZP code, which simulated a radio-frequency quadrupole (RFQ) linac, and the BEAMTRACE code, which simulated the final focusing system in a heavy ion fusion facility. We observed how well the moment equations were satisfied for various values of the independentvariable step size and the number of macroparticles. Generally, we found that the PIC codes satisfied the moment equations very well. Because our modified PIC codes were able to compute moments that satisfied the correct moment equations, we were able to use our modified version of RFQRZP, which we called RFQMOM, to work on another problem. Every moment simulation code has to include some truncation approximation. The error of this approximation can be determined by RFQMOM before actually writing the moment code. As an example, we investigated the accuracy of the truncation approximation that is used in the BEDLAM code.

4303 Auxiliaries And Components

REFER ALSO TO CITATION(S) 26037, 26052, 26087, 26092, 26546

26055 (BNL—37595) Informal proposal for an Atomic Physics Facility at the National Synchrotron Light Source. Jones, K.W.; Johnson, B.M.; Meron, M. (Brookhaven National Lab., Upton, NY (USA)). Jan 1986. Contract AC02-76CH00016. 42p. (CONF-860144—1). NTIS, PC A03. File Number DE86007805.

From Workshop on atomic physics with stored cooled heavy ion beams; Oak Ridge, TN, USA (13 Jan 1986).

An Atomic Physics Facility (APF) for experiments that will use radiation from a superconducting wiggler on the NSLS X-13 port is described. The scientific justification for the APF is given and the elements of the facility are discussed. It is shown that it will be possible to conduct a uniquely varied set of experiments that can probe most aspects of atomic physics. A major component of the proposal is a heavy-ion storage ring capable of containing ions with energies of about 10 MeV/nucleon. The ring can be filled with heavy ions produced at the BNL MP Tandem Laboratory or from independent ion-source systems. A preliminary cost estimate for the facility is presented.

26056 (BNL—37707) Thermal absorber for high power density photon beams. Ulc, S.; Sharma, S. (Brookhaven National Lab., Upton, NY (USA)). 1985. Contract AC02-76CH00016. 17p. (CONF-850734—22). NTIS, PC A02/MF A01; GPO Dep. File Number DE86008012.

From 2. international synchrotron radiation instrumentation conference; Stanford, CA, USA (29 Jul 1985).

The high power density of multipole wiggler radiation from the x-ray ring at the National Synchrotron Light Source at Brookhaven National Laboratory precludes the use of normal incidence water cooled masks and shutters due to high metal temperatures and resulting high stresses and/or deflections and the possibility of cooling water boiling. One way the power density can be reduced is by positioning the absorber surface at a small angle to the beam, a technique first developed by Lawrence Berkeley Laboratory. Finite element analyses results for temperatures, displacements and stresses are presented in this paper for a thermal absorber designed for ultra-high vacuum operation.

26057 (FNAL-TM—1390) New preamplifier for drift chambers. Zimmerman, T. (Fermi National Accelerator Lab., Batavia, IL (USA)). Mar 1986. Contract AC02-76CH03000. 17p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86009137.

A new preamplifier has been developed by T. Kondo and a monolithic version built by Fujitsu of Japan. The monolithic device, MB43468, is in a 14 pin small outline IC package and contains four amplifiers. The package is similar to the MB43458, which was built by Fujitsu for the Fermilab VTPC and covered in TM-1284. However, unlike the MB43458, the device is an inverting negative feedback amplifier, intended for positive outputs. This report documents the results of the tests performed on this device.

26058 (INIS-mf—10083) Synchrotron radiation. Appendix to the Daresbury Annual Report 1984/1985. Helliwell, J.R.; Walker, R.P. (Daresbury Lab. (UK)). 1985. 174p. NTIS (US Sales Only), PC A08/MF A01. File Number DE86701647.

A detailed account of the research work associated with the Synchrotron Radiation Source at Daresbury Laboratory, United Kingdom, in 1984/1985, is presented in the Appendix to the Laboratory's Annual Report.

26059 (KEK—84-4) New online program with encoder and memory buffer modules. Tsuru, T.; Yasu, Y.; Takashima, R. (National Lab. for High Energy Physics, Oho, Ibaraki (Japan)). May 1984. 40p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. File Number DE86701641.

A new online program using a new data acquisition system consisting of encoder and memory buffer modules is developed for the meson spectroscopy experiment, E64, at the KEK proton synchrotron. The program has a feature of a high-speed and high-rate data acquisition. It is also simple, feasible and easily extensible.

26060 (LA-UR—86-983) Rabbit system for foil activation irradiations at the Los Alamos Spallation Radiation Effects Facility at LAMPF. Davidson, D.R.; Brown, R.D.; Taylor, I.K.; Sommer, W.F.; Martinez, L. (Los Alamos National Lab., NM (USA)). 1986. Contract W-7405-ENG-36. 21p. (CONF-860421—7). NTIS, PC A02/MF A01; GPO Dep. File Number DE86008746.

From 2. international conference on fusion reactor materials (ICFRM-2); Chicago, IL, USA (13 Apr 1986).

A "rabbit" system has been installed in an insert at the Los Alamos Spallation Radiation Effects Facility (LASREF). Spallation neutrons at LASREF are produced by the passage of the LAMPF 800-MeV proton beam through the Isotope Production (IP) targets and into the beam stop. This dosimetry insert allows measurement of the spallation neutron and secondary proton fluxes and energy spectra in any of the 12 neutron irradiation locations. Four "rabbit" tubes allow radial measurements at 0.12, 0.18, 0.27, and 0.38 meters off beam centerline. Aluminum capsules ("rabbits") are used to hold the activation foils. As many as five capsules can be stacked on top of one another in each tube to allow measurements below, on, and above beam centerline. Thirteen multiple-foil activation experiments were done at these two locations. Neutron spectra were similar with the exception of the reduction of the high-energy tail outside the beam stop. The spectra outside the beam stop for eight and zero IP targets were similar in spectral shape but reduced in magnitude by a factor of two when eight IP targets were inserted into the proton beam. Measurements showed no difference in the flux below, on, or above beam centerline. With respect to the radial variation in the flux, measurements showed similar spectral shapes between the first three tubes. The fourth tube showed an enhancement in the 24-keV region due to the transmission window in the iron cross section. The "rabbit" system is available for use by experimenters at LASREF.

26061 (LBL—20581) Some new ideas about undulators. Halbach, K. (Lawrence Berkeley Lab., CA (USA)). Nov 1985. Contract AC03-76SF00098. 14p. (CONF-8510186—11). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86008372.

From International conference on insertion devices; Stanford, CA, USA (28 Oct 1985).

There are still no helical undulators that satisfy all major requirements. A new helical undulator is described that has at least some of the properties that were not obtainable until now. It can be used in a synchrotron storage ring, is completely accessible from both sides, light with both helicities can be produced, the helical field can be made quite strong, and the period length can be adjusted over a small range. Similarly, there have been some efforts lately to develop undulators with very short periods. It is shown how a hybrid undulator with a period of the order 1 mm can be constructed.

26062 (TRI-PP—85-112) Development of an accelerated radioactive beams facility using an ISOL as an injector. D'Auria, J.M. (Simon Fraser Univ., Burnaby, British Columbia (Canada). Dept. of Chemistry). Dec 1985. 4p. (CONF-850942—53). NTIS (US Sales Only), PC A02/MF A01. File Number DE86901017.

From 190. American Chemical Society national meeting; Chicago, IL, USA (8 Sep 1985).

High yields of separated, radioactive ions (up to 10^{10} atoms/sec μA of incident protons at on-line isotope separators (ISOL), e.g. ISOLDE at CERN (SC), make it feasible to consider using such secondary ions as projectiles for nuclear reactions. A pressing need for reaction rate data involving radioactive species exists in nuclear astrophysics. This requires having available projectiles ($A \leqq 60$) in the energy range from about 200 keV/amu to 1.5 MeV/amu. It has been proposed to install an ISOL device at the TRIUMF facility to utilize the available intermediate energy (200 to 500 MeV), intense ($\leqq 100$ μA) proton beam as the primary production source. The mass analyzed, radioactive beam (RB), extracted from the target/ion source at 60 keV, will be transported vertically to experimental areas and/or injected into a post-accelerator. Although other possibilities are being considered, most attention so far has been devoted to an RFQ/drift tube LINAC combination. The radioactive projectiles of initial interest are ^{13}N, ^{15}O, ^{18}F, ^{19}Ne and ^{21}Na, and it is estimated that RB intensities as high as nA are obtainable for some of these with presently available technology. These would interact with gaseous targets of H or He to perform (p,γ), (α,γ) and other simple fusion reactions of interest. A small on-line test ISOL is being designed to perform engineering research and development on these systems to optimize all production conditions to achieve highest yields.

26063 (UTTAC—48) Annual report of the Tandem Accelerator Center, University of Tsukuba. April 1, 1983-March 31, 1984. (Tsukuba Univ., Sakura, Ibaraki (Japan). Tandem Accelerator Center). 1984. 142p. NTIS (US Sales Only), PC A07/MF A01. File Number DE86701648.

The 12 UD Pelletron tandem accelerator was operated very stably through the period covered by this annual report. It was shut down for two weeks to inspect the SF_6 gas transfer system. The construction of a heavy ion post accelerator with interdigital-H structure has been completed, and chlorine ions have been accelerated to 2 MeV per charge. Effort was exerted to develop radiation detectors and a polarimeter. A windowless Si(Li) X-ray detector for PIXE was constructed, and the K X-ray of oxygen was able to be detected with high efficiency. The use of incombustible gas for ionization chambers was tested to detect the heavy ions of low Z and low energy, and nitrogen was available. A time-zero detector for heavy ion mass identification using two microchannel plates and a more elaborate high efficiency gamma detection system with six NaI (Tl) detectors and two Ge(Li) detectors were constructed. VAX 11/750-VAX 11/780 computer system was installed. Most of the research works were conducted using the beam from the Lamb-shift polarized ion source. The studies on fusion reactions using heavy ions have been continued. The accelerator and experimental facilities, and the researches in the fields of nuclear physics, atomic and solid state physics, and biology and medical science are reported.

26064 Performance of the 100 keV chopper/buncher system of the NBS-LOS alamos RTM injector. Wilson, M.A.; Cutler, R.I.; Mohr, D.L.; Penner, S.; Young, L.M. (National Bureau of Standards, Gaithersburg, MD). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-32**: No. 5, 3089-3091(Oct 1985). (CONF-850504—).

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

The purpose of the chopper/buncher system for the RTM injector is to chop a 100 keV 5 mA dc electron beam into 60°-long pulses at 2380 MHz and then bunch these beam pulses to 10° at insertion into the 5 MeV injector linac. These beam manipulations must contribute a minimum increase in the phase space of the beam such that, at the entrance to the injector linac, the transverse emittance is less than 5π mm-mrad. Phase-shift measurements on the chopped beam indicate that the bunching fields are sufficient to achieve the required longitudinal compression. Beam envelope measurements, using wire scanners on the chopped and bunched beam, show that the emittance remains within design goals.

26065 A pulsed septum magnet for the Fermilab Antiproton Source. Satti, J.A.; Holmes, S.D. (Fermi National Accelerator Laboratory, Batavia, IL). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-32**: No. 5, 3628-3630(Oct 1985). (CONF-850504—).

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

A 2 meter curved pulsed septum magnet for use in the Fermilab Antiproton Source is described. The magnet produces a peak field of 6 kGauss at a current of 20,000 Amperes within a 0.4 msec long pulse. The field uniformity obtained is $\Delta B/B < 0.2\%$ out to 3.8 cm from the copper septum. Power enters the magnet from the center resulting in very simple ends and the magnet incorporates a 0.5 cm steel guard which reduces the field to <1.4 Gauss in the zero-field region. The total septum thickness is 1.3 cm. The vacuum enclosure doubles as the stacking fixture for the magnet laminations allowing easy assembly of a magnet with a 50 m radius of curvature.

26066 Ferrite kicker magnet for the LAMPF switchyard upgrade. Hardekopf, R.A.; Higgins, E.F.; Lunsford, J.S. (Los Alamos National Laboratory, Los Alamos, NM). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-32**: No. 5, 3634-3636(Oct 1985). (CONF-850504—).

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

The new LAMPF switchyard requires a kicker magnet as the first element in the transport line leading to the Proton Storage Ring (PSR). The magnet must produce 1-ms-long pulses with 40-μs rise time and $<0.3\%$ flat-top regulation to deflect the 800-MeV H^- beam by 1.2°. We have constructed two 1-m-long, single-turn ferrite magnets, each powered by a modulator supplying up to 2400 A at a maximum rate of 24 Hz. The modulators use a transistor amplifier/regulator, a dual pulse-forming-network (PFN), and a compensating circuit driven by a function generator to achieve a total 0.1% current variation in the pulse. The system also produces an alternate kicking mode consisting of 150-μs-long pulses at a maximum rate of 120 Hz; the two modes can be multiplexed within the charging power-supply limitations.

26067 Measurement and resulting first and second order approximations for a 9 degree bending magnet in LAMPF's 750-KEV transport. Hurd, J.W. (Los Alamos National Laboratory, Los Alamos, NM). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-32**: No. 5, 3637-3639(Oct 1985). (CONF-850504—).

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

The three Cartesian components of magnetic field are measured for a 9 degree bending magnet. Measurement errors are corrected and the data is fit to a polynomial which satisfies Maxwell's equations. Particle paths through the magnet are calculated by numerical integration and the corresponding first and second order particle transformation matrices are generated. A parameterization for the first order transformation matrix is developed and the resulting approximations for predicting particle motion in the magnet are compared to the results of the numerical integration.

26068 Hybrid rare earth quadrupole drift tube magnets. Halbach, K.; Feinberg, B.; Green, M.I.; MacGill, R.; Milburn, J.; Tanabe, J. (University of California, Lawrence Berkeley Lab, Berkeley, CA). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-32**: No. 5, 3643-3645(Oct 1985). (CONF-850504—).

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

A prototype quadrupole permanent magnet with adjustable field strength has been constructed and tested. The magnet consists of iron pole pieces to provide the required field shape along with rare earth permanent magnet material (samarium cobalt) to energize the magnet. A unique feature of the configuration is the adjustability of the field by rotating the outer rings consisting of permanent

magnets and iron. Magnetic tests show small field errors coming from well understood assembly details. Mechanical tests show the design needs further consideration to ensure reliability. It is planned to use this type of magnet in the SuperHILAC prestripper drift tubes.

26069 **Design of a three channel septum magnet.** Tanabe, J.; Caylor, R.; Reimers, R. (Lawrence Berkeley Laboratory, University of California, Berkeley, CA). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-32: No. 5, 3646-3647(Oct 1985). (CONF-850504—).

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

A three channel septum magnet has been designed to service the three primary beam lines at the exit of the SuperHILAC. A pulsed switching magnet located in the next to last drift tube in the SuperHILAC poststripper diverts the beam + or - 1.09° into either the north or south port of the septum magnet. The central channel allows an undiverted beam to pass into another distribution magnet downstream. All channels may be active simultaneously and each may be tuned independently. Each septum channel contains four separate field regions and bends the beam 14.91°. Various important aspects of the design, including geometry, material selection, thermal characteristics and power requirements, are discussed.

26070 **End magnets for the NBS-Los Alamos racetrack microtron.** Debenham, P.H.; Lindstrom, E.R.; Mohr, D.L. (National Bureau of Standards, Gaithersburg, MD). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-32: No. 5, 3648-3650(Oct 1985). (CONF-850504—).

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

Two end magnets have been designed and constructed for the 185 MeV NBS-Los Alamos racetrack microtron. The field has been measured in the first magnet and is uniform over a 0.62 m^2 area to within + or - 2 X 10^{-4} at 1 T. The magnet meets all performance specifications. Field measurements are underway on the second magnet. In this paper, design and construction details which play an important role in magnetic performance are described, and the measured fields are compared with calculations.

26071 **TNsCA calculations and measurements for the SLAC slc damping ring dipole magnet.** Early, R.A.; Cobb, J.K. (Stanford Linear Accelerator Center, Stanford University, Stanford, CA). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-32: No. 5, 3654-3656(Oct 1985). (CONF-850504—).

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

The SLAC damping ring dipole magnet was originally designed with removable nose pieces at the ends. Recently, a set of magnetic measurements was taken of the vertical component of induction along the center of the magnet for four different pole-end configurations and several current settings. The three dimensional computer code TOSCA, which is currently installed on the National Magnetic Fusion Energy Computer Center's Cray X-MP, was used to compute field values for the four configurations at current settings near saturation. Comparisons were made for magnetic induction as well as effective magnetic lengths for the different configurations.

26072 **SLC arc transport system - magnet design and construction.** Fischer, G.E.; Anderson, M.; Byers, R.; Halbach, K. (Stanford Linear Accelerator Center, Stanford University, Stanford, CA). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-32: No. 5, 3657-3659(Oct 1985). (CONF-850504—).

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

This paper describes design and construction details of alternate gradient bending magnets, 950 of which are used in a single pass transport system to bring high energy positrons and electrons into head-on collision. The overall "arc" system is 8000 ft. long, has an aperture of 1/2" and a circumference factor of 96%.

26073 **SLC ARC transport system - AG-magnet measurement and performance.** Weng, W.T.; Anderson, M.; Byers, R.; Cobb, J.; Fischer, G.; Hamilton, V. (Stanford Linear Accelerator Center, Stanford University, Stanford, CA). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-32: No. 5, 3660-3662(Oct 1985). (CONF-850504—).

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

This paper describes the design, construction, and operation of devices used to rapidly measure the mechanical and magnetic properties of some 950 Alternate gradient magnets used in the arc system of the Stanford Linear Collider. The problems of dealing with the measurement of the transverse dimensions to within minute (0.0001 in) resolution of objects that are 8 ft long are discussed. Early results from the production runs of these magnets are presented.

26074 **Stress relaxation studies of CBA and SSC coil sections.** Anerella, M.; Hoffman, A.; Jackimowicz, R.; Lenz, W.; Sakaritka, J.; Tottle, D. (Brookhaven National Laboratory, Upton, NY). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-32: No. 5, 3672-3674(Oct 1985). (CONF-850504—).

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

Instrumented fixtures were built to measure coil assembly stress and relaxation rates in samples of CBA and SSC coil sections. The effects of constant temperature and thermal cycling on short and long term relaxation are presented. Conclusions and suggestions are presented to achieve minimum long term stress relaxation during the assembly and installation of the SSC rings.

26075 **Performance of four 4.5 m two-in-one superconducting R & D dipoles for the SSC.** Dahl, P.; Cottingham, J.; Fernow, R.; Garber, M.; Ghosh, A.; Goodzeit, C.; Green, A.; Herrera, J.; Kahn, S.; Kelly, E. (Brookhaven National Laboratory, Upton, NY). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-32: No. 5, 3675-3677(Oct 1985). (CONF-850504—).

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

Four 4.5 m long superconducting dipoles built to specifications similar to those for SSC Reference Design A have been successfully tested. They were wound with NbTi cable in two-layer cosθ coils of 3.2 cm inner diameter. The coil ends were flared to increase the minimum bending radius, anticipating coils wound from prereacted Nb_3Sn. The coils were mounted in a reusable "two-in-one" iron yoke prestressed by means of a bolted stainless steel shell. The first two magnets as well as the fourth one, a special magnet designed to study cross-talk between the bores, used CBA/Tevatron cable. The third utilized cable with improved ("high homogeneity") NbTi conductor. All four reached central fields corresponding to their short sample limits at 4.5K without training, nearly 6.0T for the first two magnets, 6.5T for the third, and 5.4T for the fourth. At 2.5K modest training was required to reach short sample limits of 7.2T, 7.1T, 7.8T, and 6.6T respectively. The measured values of the allowed harmonics were within several X 10^{-4} of the calculated ones.

26076 **Results from heater-induced quenches of a 4.5 m two-in-one superconducting R&D dipole for the SSC.** Ganetis, G.; Prodell, A. (Brookhaven National Laboratory, Upton, NY). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-32: No. 5, 3678-3680(Oct 1985). (CONF-850504—).

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

Quench studies were performed using a 4.5 m long SSC R&D dipole to determine the temperature rise during a quench by measuring the resistance of the conductor cable in the immediate vicinity of the quench. The 2-in-1 magnet was wound with improved "high homogeneity" NbTi conductor in a 2-layer cosine θ coil configuration of 3.2 cm inner diameter with each layer powered separately to simulate graded conductor. Twelve pairs of voltage taps were installed at various locations in the coils around one

bore of the magnet. "Spot" heaters were placed between the voltage taps of 8 of these pairs to initiate magnet quenches. The resistance of the conductor was obtained from observations of the current and voltage during a magnet quench. The temperature of the conductor was then determined by comparing its resistance to an R vs T curve measured independently for the conductor. The quantity $\int I^2dt$ is presented as a function of current and location, and the maximum conductor temperature is shown as a function of $\int I^2dt$ and location. Measured longitudinal and azimuthal quench propagation velocities are also presented.

26077 **Large acceptance magnetic focussing horns for production of a high intensity narrow band neutrino beam at the AGS.** Carroll, A.; Chimienti, L.; Leonhardt, W.; Monaghan, R.; Ryan, G.; Sandberg, J.; Sims, W.; Smith, G.; Stillman, P.; Thorwarth, H. (Brookhaven National Laboratory, Associated Universities, Inc., Upton, NY). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-32: No. 5, 3054-3056(Oct 1985). (CONF-850504—).

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

A set of two large acceptance (20 to 140 mrad) horns have been designed and built to form a parallel beam of 3 GeV/c pions and kaons for the production of an intense, dichromatic neutrino beam. A set of beam plugs and collimators determined the momentum of the particles which pass through the horns. The cooling and maintenance of the horns and target was a particular concern since they were operated with an incident intensity of over 10^{13} proton/sec. These systems were designed for simplicity, reliability, and easy replacement.

26078 **Beam catcher/dump.** Makdisi, Y.; Brown, K.; Glenn, J.W.; Rodger, E. (AGS Department, Brookhaven National Laboratory, Upton, NY). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-32: No. 5, 3057-3059(Oct 1985). (CONF-850504—).

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

A simple, low cost aperture limiting device with an absorber block has been developed and installed in the AGS ring at Brookhaven National Laboratory. The device intercepts injection tails, transition losses, and the inward spiraling beam of an aborted accelerations or extraction cycle. The resultant consolidation of losses at one point reduces activation of components around the ring and radiation exposure to personnel.

26079 **Improvement of the high voltage properties of the Fermilab electrostatic septa.** Trbojevic, D.; Childress, S.; Crawford, C.; Tinsley, D. (Fermi National Accelerator Laboratory, Batavia, IL). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-32: No. 5, 3074-3076(Oct 1985). (CONF-850504—).

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

In the Fermilab Tevatron Switchyard proton beam splits are initiated by a wire array electrostatic septum. At 1 TeV energy, and with fields limited to 50 kV/cm, and electrostatic septum more than 20 meters in length is required to produce the required angular separation between the beams for the Proton and Neutrino/Meson lines. New techniques have been investigated that will allow reliable operation at fields above 75 kV/cm with resultant beam line economy. Changes in construction and conditioning procedures have been studied using a short sample of an electrostatic septum.

26080 **New, semi-remote handling target stations in the Fermilab Experimental areas.** Eartly, D.; Currier, R.; Lindberg, J.; Sobczynski, S.; Strickland, W. (Fermi National Accelerator Laboratory, Batavia, IL). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-32: No. 5, 3072-3073(Oct 1985). (CONF-850504—).

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

Six additional, isolated, and self-contained target stations are being built as part of the upgrade of the three Fermilab Fixed-Target experimental areas. One new system of shielding and semi-remote component handling via a crane has been developed for all of these. Two stations are being operated and two more are under test. The applied system is simple and flexible. It successfully provides semi-remote handling of components within the shielding of the stations.

26081 **Beam tests of A 2 cm diameter lithium lens.** Fiander, D.C.; Dugan, G.; Hojvat, C.; Johnson, C.D.; Lennox, A.; Maury, S.; Sherwood, T.R. (CERN, Geneva). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-32: No. 5, 3063-3065(Oct 1985). (CONF-850504—).

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

Following the pioneering work on lithium lenses at INP, Novosibirsk, a 2 cm diameter lens was designed and built at Fermilab as an antiproton collector for the antiproton source of the Tevatron I project. A lens of this type was tested at the CERN Antiproton Accumulator (AA) as an antiproton collector and then as a prefocusing element before the AA pulsed current target. In the latter case the purpose was to increase the proton beam convergence at the target to compensate the defocusing effect on the proton beam of the current in the target. As an antiproton collector the lithium lens performed as predicted increasing the antiproton yield into the AA by 40%. In the prefocusing configuration beam convergence and spot size on the target were considerably improved over the standard arrangement using a pulsed quadrupole triplet and the lens has survived 1.4 M pulses of current from 290 to 350 kA in a 26 GeV/c beam of up to 1.4×10^{13} protons.

26082 **LAMPF transition-region mechanical fabrication.** Bush, E.D.; Gallegos, J.D.F.; Harrison, R.; Hart, V.E.; Hunter, W.T.; Rislove, S.E.; Sims, J.R.; VanDyke, W.J. (Los Alamos National Laboratory, Los Alamos, NM). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-32: No. 5, 3083-3085(Oct 1985). (CONF-850504—).

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

The new Transition Region (TR-II) optimizes phase matching of H^+ and H^- beams during simultaneous transport between the drift-tube linac and side-coupled linac at LAMPF. Improvements include larger aperture, a straight beam track, greater beam path length adjustments, and better utility routing. Hardware density required innovative designs for magnets, mounting, vacuum, and utilities. Dipoles are powered by one constant current and one variable current supply which cause the fields to add or buck providing + or -20-mm path length variation for phase lAtching. Alignment was done using two digital theodolites coupled to a computer to give real-time three-dimensional data. Production beams up to 950 μA at 100 MeV have been routinely transported since September 1983.

26083 **New 750 KEV H^- beam transport line for LAMPF.** Butler, H.S.; Browman, A.A.; Hagerman, D.C.; Jakobson, M.J. (Los Alamos National Laboratory, Los Alamos, NM). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-32: No. 5, 3086-3088(Oct 1985). (CONF-850504—).

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

The injector complex at LAMPF consists of three injectors with associated transport lines to deliver H^+, H^-, and P^- beams to the linac. Early in 1984 the original H^- injector (circa 1973) was replaced with one capable of producing a peak current of 20-mA, a 100X improvement. The motivation for this upgrade was the addition of a proton Storage Ring (PSR) for pulsed neutron research. To support the new operating modes associated with the PSR, the H^- transport line was replaced by one having a different design that required changes to portions of the H^+ and P^- lines, also. This paper describes the new transport system and reports on the initial performance of the H^- line.

26084 **Laser generation and transport of a relativistic electron beam.** Shope, S.L.; Crist, C.E.; Frost, C.A.; Godfrey, B.B.; Kiekel, P.D.; Leifeste, G.T.; Poukey, J.W. (Sandia National Laboratories, Albuquerque, NM). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-32**: No. 5, 3092-3094(Oct 1985). (CONF-850504—).

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

A foilless diode usually requires an externally applied magnetic field to control expansion and transport of a relativistic electron beam. A new foilless diode has been developed that does not require an external magnetic field. A low pressure organic gas is introduced into the diode and the transport region. A UV laser beam is injected through the transport region and is terminated at the cathode. The laser photoionizes the low pressure gas forming an ionized channel that captures the electron beam near the cathode. The electron beam is focused and guided by electrostatic attraction to the ionized channel. A 1.5-MeV, 20-kA electron beam has been generated and transported 1 m using this technique. The laser was replaced by an 800-V, 250-ma, low-energy electron beam which was used to guide the relativistic electron beam 4 m through a 90° bend.

26085 **Major facility overhauls at LAMPF.** Grisham, D.L.; Lambert, J.E.; Sommer, W.F. (Los Alamos National Laboratory, Los Alamos, NM). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-32**: No. 5, 3095-3097(Oct 1985). (CONF-850504—).

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

The Clinton P. Anderson Meson Physics Facility (LAMPF) is a linear proton accdLerator designed to operate at 800 MeV and 1.0 mA. It has been operating at power levels above 200 microamperes since February of 1976 and now routinely operates near the design level. This paper outlines the problems encountered with the original target cell components, the repairs required since 1976, and specifically details the steps involved in the complete replacement of the vital target cell components. These components include target boxes, collimators, main beam line magnets, and the front-end magnets of the secondary beam lines. The A-2 target cell was replaced in the spring of 1983 and the A-1 target cell was replaced in the spring of 1984. Both have operated satisfactorily since their completion, with only minor difficulties. The overhaul and total component replacement in the beam stop area (A-6) was completed in early May 1985 and has just been placed in operation. The upgrade, in addition to the replacement of the beam stop and the vacuum-to-air window with state-of-the-art designs, provides a greatly increased capability of both proton and neutron irradiation of materials.

26086 **Polarized proton acceleration at the AGS.** Krisch, A.D. (Randall Lab of Physics, The University of Michigan, Ann Arbor, Michigan 48109-1120). *AIP (American Institute of Physics) Conference Proceedings;* **131**: No. 1, 45-46(30 Jul 1985).

Several modifications are described in the AGS accelerator complex for accelerating and extracting polarized proton beams. To maintain polarization during the acceleration cycle, several fast pulsed quadrupole magnets were installed around the AGS ring. A significant increase in momentum from 16.5 GeV/c, achieved in July, 84 is expected in 1985. (AIP)

4304 Storage Rings

REFER ALSO TO CITATION(S) 26066, 26074

26087 **Some uses of REPMM's in storage rings and colliders.** Spencer, J.E. (Stanford Linear Accelerator Center Stanford University, Stanford, CA). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-32**: No. 5, 3666-3668(Oct 1985). (CONF-850504—).

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

Improvements for existing rings and techniques for building new rings composed entirely of passive, Rare Earth Permanent Magnet Multipoles (REPMM's) are considered using circular dipoles, quadrupoles and sextupoles. Over the past few years we have made such magnets using a single size $SmCo_5$ block with up to five easy-axis orientations. The final production scheme is modular in that magnets are built-up from quantized layers. All multipole layers are made in exactly the same way using algorithms differing only by the desired multipole symmetry. The method is simple, efficient and inexpensive and allows a "do-it-yourself" approach to constructing new magnetic elements. For rings these might include focusing optical klystrons, rotatable multipoles for diagnostics, correction or extraction, or possibly combined function systems for the unit cells. A high quality, low-beta, PMQ insertion which can change beta, tune and energy is described as well as the PMS's for the SD and SF elements of the North SLC damping ring. Because these sextupoles will be the first optical use of PM's in storage rings they are discussed in detail together with the advantages, problems and requirements of such applications.

26088 **(FNAL/Trans—353) Antiproton source for the accelerator-storage complex.** Vsevolozskaja, T.; Grishanov, B.; Derbenev, Y.; Dikansky, N.; Meshkov, I.; Parkhomchuk, V.; Pestrikov, D.; Silvestrov, G.; Strinsky, A. (Fermi National Accelerator Lab., Batavia, IL (USA)). Dec 1981. Contract AC02-76CH03000. Translation of original Preprint 80-182 (INP - Novosibirsk). 88p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE86007089.

In this article we present the design of the antiproton source for the UNK complex. Antiprotons are produced at 5.5 GeV/c momentum by targeting the proton beam of the U-70 synchrotron. They are decelerated to 400 MeV energy in a special decelerator synchrotron. The antiprotons are transferred to a cooler-accumulator ring where they are cooled and accumulated into an intense stack using the electron cooling method. The energy of 400 MeV is chosen for optimum electron cooling performance. An important feature of this cooler-accumulator is the very long cooling straight sections (2 x 100 m), which become part of the focusing structure. A scenario is presented for an accumulation rate of 5×10^7 anti p/s. Some improvements of this scenario are discussed, and an accumulation rate of about 10^9 anti p/s is predicted as attainable. A luminosity of 3×10^{30} cm^{-2} s^{-1} can be obtained for p anti p collisions with 10^{12} particles at 3 TeV per beam. 15 refs., 19 figs.

44 INSTRUMENTATION

4401 Radiation Instrumentation

REFER ALSO TO CITATION(S) 25439, 25444, 26057, 26140, 26346, 26546, 26551, 26601, 26646

26089 **(AD-A—162718/1/XAB) On-orbit support of DARPA-301 payload. Final report.** Imhof, W.L.; Mobilia, J.; Datlowe, D.W.; Nakano, G.H.; Gaines, E.E. (Lockheed Missiles and Space Co., Palo Alto, CA (USA). Lockheed Palo Alto Research Lab.). 12 Nov 1985. 21p. (LMSC/F—067835). NTIS, PC A02/MF A01.

This report covers the DARPA-301 payload on the P78-1 satellite. Until the middle of September 1985 several high-sensitivity gamma-ray detectors continued to perform well and were completely capable of fulfilling the mission objectives. These objectives were: A) Provide the technical planning and liaison with the Air Force Satellite Control Facility and other government agencies as required for the on-orbit satellite support of the DARPA-301 payload; B) Assess the on-orbit operation and quality of data from the DARPA-301 payload on the P78-1 satellite; C) Provide support, including quick-look analysis and interactions with the Air Force Satellite Control Facility, for a regional event; and D) Perform regular analyses of the on-orbit data to maintain updated evaluations of the sensitivities and optimum configurations of the payload for mapping gamma-ray sources.

26090 (DOE/ER/40025—T3) Prototype for SLD endcap drift chambers. Canova, B.; Carr, J.; Gabella, W.; Hinshaw, D.; Nauenberg, U. (Colorado Univ., Boulder (USA)). [1986]. Contract AC02-81ER40025. 8p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86007020.

As a step in the design process for the SLD endcap drift chambers, a small prototype has been constructed and tested. This first prototype, PROTOTYPE I, consists of three drift cells each with the drift dimensions and electrostatic configuration intended for the real system but with a wire length which is half the maximum planned for the final system.

26091 (DOE/ER/40149—1(2)) Continued studies of nuclei far from stability. Progress report, 15 September 1984-30 September 1985. Rester, A.C. (Florida Univ., Gainesville (USA). Space Astronomy Lab.). [1986]. Contract FG05-84ER40149. 30p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86004399.

Successful use of the PANDA neutron-multiplicity detector is reported, along with a new detector for nuclear charge determination on ions emitted in nuclear reactions and fission. Neutron-gamma coincidence experiments are reported, and an experiment in preliminary stages is described which examines the polarization and angular distributions of ^{72}Br. (LEW)

26092 (FNAL-TM—1384) Amplifier-Discriminator-Multiplexor card. Graupman, D. (Fermi National Accelerator Lab., Batavia, IL (USA)). Feb 1986. Contract AC02-76CH03000. 19p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86009136.

The Amplifier-Discriminator-Multiplexor (ADM) card described was designed for the External Muon Identifier at the 15 ft Bubble Chamber. The general scheme of the data readout of the External Muon Identifier is based on the use of a master clock. The ADM card serves to amplify the signals from the proportional tubes, discriminate them, latch the signals in parallel into a shift register. The data are then shifted out serially to the Time Digitizing System, using the master clock. The shift registers are loaded, and the latches are reset every sixteen cycles of the master clock. (LEW)

26093 (FNAL-TM—1386) Tests of a single-wire drift chamber for possible use in low intensity beams. Haggerty, H. (Fermi National Accelerator Lab., Batavia, IL (USA)). Feb 1986. Contract AC02-76CH03000. 22p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86008124.

A single cell drift chamber with two dimensional readout has been evaluated as a candidate for reliable and inexpensive momentum tagging of low intensity calibration beams. Charges induced on shaped cathode pads allow a measurement of the coordinate parallel to the wire, while the drift time allows a measurement of the coordinate perpendicular to the wire. Two chamber orientations were used during the tests. In one the chambers were arranged with their wires parallel. In this case the intrinsic resolution of the chambers was measured; the top and bottom cells were used to define a track coordinate and this was compared to the coordinate in the middle chamber. To see if either of the two coordinate measurements is linear in real space, the chambers were rearranged to the second orientation, with the middle chamber rotated 90°. The drift time was plotted against the charge ratio. The conclusion drawn from this study is that while the drift time measurement has adequate resolution, the charge ratio measurement is not a viable option for beam line use. (LEW)

26094 (GSI—85-54-Prepr.) Low pressure avalanche detectors in relativistic heavy ion experiments. Albrecht, R.; Daues, H.W.; Gustafsson, H.A.; Gutbrod, H.H.; Kolb, B.W.; Ritter, H.G.; Schulze, R.; Stelzer, H.; Wieman, H.; Kampert, K.H. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Muenster Univ. (Germany, F.R.); Marburg Univ. (Germany, F.R.); Lawrence Berkeley Lab., CA (USA)). Oct 1985. 27p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86751100.

Large area, low mass, multiwire avalanche chambers have been developed for relativistic heavy ion experiments. These detectors handle large multiplicities of charged particles and provide position, time-of-flight and ΔE-information over a large dynamic range. (orig.).

26095 (INFN/AE—82-10) Microprogrammable processor ESOP in a small elastic scattering experiment. Birsa, R.; Bradamante, F.; Dalla Torre, S.; Giorgi, M.; Lanceri, L.; Martin, A.; Moras, P.; Penzo, A.; Schiavon, P.; Villani, A. (Istituto Nazionale di Fisica Nucleare, Pisa (Italy)). 1982. 12p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701634.

The microprogrammable processor ESOP has been introduced in the trigger system of a small angle elastic scattering experiment on a polarized proton beam at the Saturne synchrotron. Its implementation in a data acquisition system based on a Hewlett-Packard computer is described and preliminary results on the performance of a straight tracks rejecting algorithm are presented.

26096 (INFN/TC—85-6) Construction of lead glass tubing matrices for applications in medical physics and high energy physics. Schwartz, G.; Conti, M.; Del Guerra, A.; Cinti, M.; Di Fino, M.; Habel, R.; Perez-Mendez, V. (Istituto Nazionale di Fisica Nucleare, Rome (Italy); ENEA, Frascati (Italy). Centro Ricerche Energia; Lawrence Berkeley Lab., CA (USA)). 1985. 14p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701635.

Honeycomb matrices which act both as gamma ray converter/radiators and electron drift structures have been manufactured from lead glass tubing of high density (5-6 g/cm^3). Baking the tubing in a reducing atmosphere produces a resistive metallic layer which can be used as a continuous voltage divider for drift field shaping. The application of a multiwire proportional chamber/converter detector to positron emission tomography is described; arrays of lead glass capillaries (< 1.0 mm inner diameter) are used as converter for the 511 keV annihilation photons. Another application is under study in high energy physics, a high density projection chamber in electromagnetic calorimetry. The various phases of the construction of these lead glass matrices for both applications are described in detail.

26097 (INFN/TC—85-9) Time of flight mass spectrometer for the analysis of molecular ions produced by plasma desorption. Bressanini, G.; Castellano, C.; Galeazzi, G.; Prete, G. (Istituto Nazionale di Fisica Nucleare, Rome (Italy)). 1985. 9p. (In Italian). NTIS (US Sales Only), PC A02/MF A01. File Number DE86701636.

A time of flight spectrometer is described to be used in measurements of molecular mass in the range 1-2000 amu, produced by plasma desorption (induced by a Cf-252 source).

26098 (INIS-BR—427) Construction and tests of a gamma device for experimental measurements of burnup of nuclear reactor fuel. Brandao Junior, F.A. (Minas Gerais Univ., Belo Horizonte (Brazil). Dept. de Engenharia Nuclear). 1982. 104p. (In Portuguese). NTIS (US Sales Only), PC A06/MF A01. File Number DE86701633.

The gamma-scanning method is an important tool for the measurement of burnup of nuclear reactor fuel. The adequate knowledge of burnup allows for a better inventory of 'sensitive' fissile materials, better fuel management and provides insight on fuel behaviour and safety margins. This paper is related to the description, construction and operation of a first gamma scanning device, tested by irradiation of prototype PWR fuel pins, 14 cm long, in a Triga Mark-I reactor at very low power. Despite the limitations imposed by the low burnup, the experiment permitted a good checking of the main physical concepts and devices involved in the method.

26099 (INIS-mf—10046) Calibration of germanium detectors. Bjurman, B.; Erlandsson, B.; Mattsson, S. (Lunds Lasarett (Sweden); Lund Univ. (Sweden). Dept. of Radiation Physics; Sahlgrenska Sjukhuset, Goeteborg (Sweden)). 1985. 10p. (CONF-8502113—12). NTIS (US Sales Only), PC A02/MF A01. File Number DE86701434.

From 4. Nordic seminar on radioecology; Gol, Norway (27 Feb 1985).

This paper describes problems concerning the calibration of germanium detectors for the measurement of gamma-radiation from environmental samples. It also contains a brief description of some ways of reducing the uncertainties concerning the activity determination. These uncertainties have many sources, such as counting statistics, full energy peak efficiency determination, density correction and radionuclide specific-coincidence effects, when environmental samples are investigated at close source-to-detector distances.

26100 **(INIS-mf—10055) Efficiency calculation of germanium detectors for different sample geometries.** Sinkko, K.; Levomaeki, E. (Institute of Radiation Protection, Helsinki (Finland)). 1985. 7p. (CONF-8502113—13). NTIS (US Sales Only), PC A02/MF A01. File Number DE86701435.

From 4. Nordic seminar on radioecology; Gol, Norway (27 Feb 1985).

In gamma-ray spectroscopy the experimental evaluation of the peak efficiencies of extended sources are arduous due to various shape of samples and different matrix materials. In this work the peak efficiencies are calculated by a semi-empirical method for different sample geometries. The method is based on efficiency calculation by numerical integration developed for Na(I)-crystals, and on a new approach presented by Moens et. al. The advantage of the method is the simplicity of experimental calibration. Only one point-source calibration is needed to evaluate any other extended source calibration.

26101 **(INIS-mf—10061) Detection limits and isotope identification.** Nielsen, S.P. (Risoe National Lab., Roskilde (Denmark)). 1985. 13p. (In Danish). (CONF-8502113—11). NTIS (US Sales Only), PC A02/MF A01. File Number DE86701428.

From 4. Nordic seminar on radioecology; Gol, Norway (27 Feb 1985).

The paper deals with the calculation of detection limits in connection with gamma spectroscopy. Some practical examples are given. A method for automatic isotope identification is described.

26102 (INIS-SU—315, pp 206-211) **Independent measuring station of on-line measurement system for the GNEIS neutron spectrometer.** Gorokhov, I.S.; Laptev, A.B.; Marchenkov, V.V.; Tubol'tsev, Yu.V.; Fokin, E.Yu.; Shcherbakov, O.A. (AN SSSR, Leningrad. Inst. Yadernoj Fiziki). 1984. (In Russian). NTIS (US Sales Only), PC A18/MF A01. File Number DE86780375. (CONF-8310228—Vol.4).

From 6. Soviet national conference on neutron physics; Kiev, USSR (10 Oct 1983).

An autonomous metering station (AIST) purposed for information-metering system of neutron time-of-flight spectrometer GNEIS is described. It allows to carry out time and time-amplitude measurements in autonomous operation, and to send the results to the main computer after that. The description of the station hardware and software is given.

26103 (JINR—D-13-84-53, pp 104-108) **Proportional counter with uniform electric field with Penning's mixture.** Pawlowski, Z.; Marzec, J.; Zaremba, K. (Politechnika Warszawska, Poland. Inst. Radioelektroniki). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781324. (CONF-8309239—).

From 11. international symposium on nuclear electronics; Bratislava, Czechoslovakia (13 Sep 1983).

Some calculations are given and the design of proportional counters with a homogeneous electric field filled with Penning's mixtures, which ensure the best energy resolution is described. The counters with mixtures of Ne+Ar, Ne+CH_4, Ne+CO_2 and Ar+C_2H_2 have been checked. The admixtures (Ar, CH_4, CO_2, C_2H_2) constitute from 0.1 to 2%, with pressure from 125 Tr to 760 Torr. The best energy resolution has been obtained for the mixture of Ne+1%CH_4 at the pressure of 190 Torr.

26104 **(JINR—R-6-85-268) Gamma-ray energy standards used in calibration of spectrometers based on semiconductor detectors.** Gorozhankin, V.M.; Brudanin, V.B.; Vylov, Ts.; Marinov, A.T.; Ivanov, A.I.; Uchevatkin, I.F.; Rukhadze, N.I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems; Vsesoyuznyj Nauchno-Issledovatel'skij Inst. Metrologii, Leningrad (USSR); Tbilisskij Gosudarstvennyj Univ. (USSR)). 1985. 11p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE86701429.

Assuming Esub(γ)411.8(sup(198)Hg)=411.8044+0.0011 keV and using the gamma-ray energies of ^{183}Ta and ^{192}Ir measured by means of crystal-diffraction spectrometers a set of gamma-ray energy standards (up to 3500 keV) has been obtained. Accurate energy values are proposed for > 4000 keV spectrometer calibration obtained on the base of mass-spectrometric data.

26105 **(JINR—R-13-85-215) Apparatus with gas-discharge detectors of ionizing radiation and methods for its diagnostics.** Onishchenko, L.M.; Shishkin, A.L. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1985. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE86701426.

Submitted to the journal Instrum. Exp. Tech. .

Circuits of devices with gas-discharge detectors of ionizing radiation and methods for checking their serviceability without the use of radioactive sources are described. Diagnostics is carried out by controlling the parameters of the brush discharge in detectors. This technique is good for any gas-discharge detectors; it has a number of advantages over the traditional control with the use of radioactive sources, does not require much time (0.1 sec) for checking the devices and ensures the necessary accuracy and reliability of measurements. Electronic circuits of the devices are quite simple and allow easy automation of the diagnostic process. Results of this work can be employed in instruments and multichannel systems for control over ionizing radiation levels.

26106 **(JINR—R-13-85-265) Optical system of the 100 cm hydrogen bubble chamber.** Almazov, V.N.; Glagolev, V.V.; Glushchenko, V.N. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1985. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE86701430.

Optical system of the 100 cm hydrogen bubble chamber of JINR Laboratory of High Energies are described. The chamber has a retrodirective system of darkfield illumination with prismatic raster of total internal reflection and a stereophotogrammetric apparatus. It includes four photogrammetric cameras with special lenses elaborated making allowance for the compensation of medium distortions in the object space and smoothing plates prepared from quartz glass. Registration of service information for measurement of track coordinates in scanning automatic devices is provided.

26107 **(KEK—84-10) Construction of self-supporting cylindrical multiwire proportional chambers.** Kobayashi, Masaaki; Fujitani, Takeo; Omori, Tsunehiko; Sugimoto, Shojiro; Yamaguchi, Yoshitake; Nakagawa, Yuji; Wada, Toshiaki. (National Lab. for High Energy Physics, Oho, Ibaraki (Japan)). Aug 1984. 19p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701637.

Cylindrical MWPC's have been constructed with 240-430 mm in anode diameter and 750 mm in length. They are supported by inner and outer cathode cylinders made of approximately 6 mm thick aramid fibre/phenolic resin honeycomb, sandwiched between 50 μm thick Kapton sheets with or without Cu strips laminated to them. The chambers have been successfully used throughout the E68(P-barPC) experiment at the KEK 12 GeV Proton Synchrotrons. Constructional details are described.

26108 **(OUP—85-09) On the determination of shower central positions from lateral samplings.** Bugge, L. (Oslo Univ. (Norway). Fysisk Inst.). Jun 1985. 32p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86701431.

An algorithm for reconstructing the central position of a shower from lateral samplings is described. The method is applied

to electromagnetic showers seen by a granular lead-scintillator sandwich. The results are compared to other methods and to Monte Carlo simulations.

26109 **(PB—86-129756/XAB) Radiometric calibration procedures using the NBS (National Bureau of Standards) MARBLE Electronics Package. Final report.** Mickelson, M.E.; Larson, L.E.; Fowler, J. (National Bureau of Standards, Washington, DC (USA). Center for Radiation Research). Sep 1985. 23p. (NBS/TN—1216). NTIS, PC A02/MF A01.

The NBS MARBLE Electronics Package, which is designed to support calibration of radiometric detectors, including self-calibration of Si photodiodes, is described.

26110 **(RISO-M—2508) Properties of commercial PVC-films with respect to electron dosimetry.** Miller, A.; Liqing, X. (Risoe National Lab., Roskilde (Denmark)). May 1985. 18p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701427.

The properties of three commercially available polyvinyl chloride (PVC) film supplies and one made without additives were tested with respects to their application as routine dose monitors at electron accelerators. Dose fractionation was found to increase the response and the post-irradiation heat treatment was very critical for some of the films.

26111 **(SIS—1985:8) Measurement of radioactivity in rain. Try out method and start up of routine measurements.** Eivindson, T. (Statens Inst. for Straalehygiene, Oslo (Norway)). 1985. 41p. (In Norwegian). NTIS (US Sales Only), PC A03/MF A01. File Number DE86701437.

The report gives a description of an ion-exchange surveillance- sampler for routine measurements of radioactivity in rain, and how the measurements are performed. Using the nuclides ^{85}Sr, ^{131}I and ^{137}Cs as tracers, experiments have been performed to determine the distribution of radioactivity in the ion-exchange column and the effectiveness of the column as a function of elutriation rate and temperature.

26112 **(SIS—1985:11) Radioactive pollution in rainfall. Measurement station at the National Institute for Radiation Hygiene.** Jemtland, R. (Statens Inst. for Straalehygiene, Oslo (Norway)). 1985. 27p. (In Norwegian). NTIS (US Sales Only), PC A03/MF A01. File Number DE86701436.

Routine measurements of radioactivity in rainfall are carried out at the National Institute for Radiation Hygiene, Norway. The report discusses why the method of ion exchange was selected and gives details on how the measurements are performed.

26113 (TNO-REP—1983, pp 3-5) **Response of a high-pressure ionization chamber in dependence on filling gas and radiation quality.** Zoetelief, J.; Engels, A.C.; Hennen, L.A.; Broerse, J.J. 1983. NTIS (US Sales Only), PC A12/MF A01. File Number DE86780441.

In REP annual report 1983.

Studies on the characteristics of ionization chambers as a function of the pressure of various filling gases are of interest in radiation protection. The tissue equivalent (TE) ionization chambers used for dosimetry in radiobiology have too low a sensitivity for application in radiation protection and provide no information on radiation quality. These restrictions might be resolved by operating ionization chambers at higher gas pressures. With the aim of obtaining a detector with a greater sensitivity, the reading of the high-pressure ionization chamber has been studied for other gases by use of ^{137}Cs γ rays. For various gases, the relative reading as a function of gas pressure is shown.

26114 **(TRI-PP—85-91) Position identification of gamma rays and electrons with a multianode photomultiplier.** Salomon, M.; Marans, J. (TRIUMF, Vancouver, British Columbia (Canada)). Oct 1985. 3p. (CONF-851009—66). NTIS (US Sales Only), PC A02/MF A01. File Number DE86901015.

From IEEE nuclear science symposium; San Francisco, CA, USA (23 Oct 1985).

We have studied the properties of a multianode photomultiplier coupled to a large scintillator and the capabilities of such a system to obtain position information of the impinging radiation. We found a position resolution of 7.0 +- 0.5 mm FWHM using a centre-of-gravity method.

26115 **(USIP—85-10) NA27 trigger.** Bizzarri, R.; Di Capua, E.; Falciano, S.; Iori, M.; Marel, G.; Piredda, G.; Zanello, L.; Haupt, L.; Hellman, S.; Holmgren, S.O. (Stockholm Univ. (Sweden). Inst. of Physics). May 1985. 29p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86701432.

We have designed and implemented a minimum bias trigger together with a fiducial volume trigger for the experiment NA27, performed at the CERN SPS. A total of more than 3 million bubble chamber pictures have been taken with a triggered cross section smaller than 75% of the total inelastic cross section. Events containing charm particles were triggered with an efficiency of 98^+2sub(-3)%. With the fiducial volume trigger, the probability for a picture to contain an interaction in the visible hydrogen increased from 47.3% to 59.5%, reducing film cost and processing effort with about 20%. The improvement in data taking rate is shown to be negligible.

26116 **A $^2D(\gamma,n)^1H$ tritiated water detector with $^{232}U/^{228}Th$ source.** Baumann, N.P.; Winn, W.G. (E.I. du Pont de Nemours and Co., Savannah River Lab., Aiken, SC 29808). *Nuclear Technology;* 72: No. 3, vp(Mar 1986). Contract AC09-76SR00001.

A long-lived gamma source, containing 370 MBq of ^{232}U (72 yr) and 110 MBq of ^{228}Th (1.9 yr), was developed as a permanent replacement for neutron-activated ^{24}Na (15-h) sources that have been used in a $^2D(\gamma,n)^1H$ tritiated water detector. The ^{228}Th, which will build up to 340 MBq in 10 yr and then decay in equilibrium with ^{232}U, emits copious 2614-keV gamma rays for the (γ,n) process. Competing (α,n) backgrounds are reduced by placing the uranium/thorium source in a gold matrix to provide threshold and coulomb barriers against the reaction. The detection limits ($\approx$0.01-ml D_2O) for typical stainless steel pipes ($\approx$2 cm diam) measured with the uranium/thorium source are almost as low as those for comparable ^{24}Na sources, which do not produce (α,n) backgrounds. This minor sensitivity loss can be offset by longer counting times, if necessary. Lower personnel exposure is realized with the new source. Overall, the practical advantages of using a longer lived source strongly favor the use of $^{232}U/^{228}Th$ instead of ^{24}Na.

26117 **Semiconductor drift chambers.** Lutz, G.; Goulding, F.; Luke, P.N.; Madden, N.W.; Waltor, J.; Wylie, A. (Brookhaven National Laboratory, Upton, NY). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-32: No. 2, 1204-1208(Apr 1985).

Semiconductor drift chambers for position and energy measurements have been invented, built and tested. A short 'Ccount is here given on the principles of the drift chamber and on the experimental results. Detailed reports have been written on the quoted bibliography and new reports will be published shortly.

26118 **Simple MCA supports a variety of applications.** Wolf, M.A.; Staley, H.C. (Los Alamos National Lab., Los Alamos, NM). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-32: No. 1, 82-83(Feb 1985). (CONF-841007—).

From Nuclear science symposium; Orlando, FL, USA (31 Oct 1984).

A greatly enhanced version of the Violinist I, Simple Multichannel Analyzer has been developed at Los Alamos. The new instrument includes a more powerful microprocessor, more memory, and a sophisticated set of I/O devices. The combination of these features allow the same basic electronics package to function in a variety of "smart" sophisticated monitoring instruments. Only the packaging, detector, and software need be changed to change the instrument from a field survey instrument for Pu contamination to a continuous air monitor to a neutron dosimeter. This instrument should spawn a new generation of user-friendly, highly effective instrumentation.

26119 A semiempirical method for calculating detector efficiency as a function of distance. Hsu, H.H.; Lucas, M.C.; Mack, J.M.; Moss, C.E. (Los Alamos National Lab., Los Alamos, NM). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-32: No. 1, 46-49(Feb 1985). (CONF-841007—).

From Nuclear science symposium; Orlando, FL, USA (31 Oct 1984).

The assumption that the efficiency of a detector varies as the inverse square of the distance is valid only for a point source and a point detector in vacuum. To account for the finite size of the detector, we use the idea of an effective interaction center for that detector. The detector efficiency can then be described as varying with the inverse square of the distance between the source and the energy-dependent location of the effective interaction center. We present two simple expressions, one for the location of the effective interaction center and one for a normalization parameter. The expressions were obtained by a two-stage fitting procedure and are valid for gamma-ray energies between 60 keV and 2.615 MeV at distances of 10 cm or greater. The efficiencies so obtained agree with measurements to about 5%.

26120 Germanium detectors with a built-in transverse drift field. Luke, P.N.; Goulding, F.S.; Madden, N.W. (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-32: No. 1, 457-462(Feb 1985). (CONF-841007—).

From Nuclear science symposium; Orlando, FL, USA (31 Oct 1984).

A new kind of position-sensitive germanium detector based on a novel mode of charge transport is proposed and experimental devices have been fabricated. In these germanium "drift-chambers", position information is obtained by measuring carrier drift times. Onedimensional spatial resolutions of < about0.5 mm over an active area of about 2.5 x 2.5 cm^2 have been achieved in one detector for 60 keV photons. The simplicity of such detectors makes them attractive as positionsensitive gamma-r'Y spectrometers compared to discrete element detectors. The problems and limitations of the present detectors are discussed.

26121 Assessment of present and future large-scale semiconductor detector systems. Spieler, H.G.; Haller, E.E. (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* NS-32: No. 1, 419-426(Feb 1985). (CONF-841007—).

From Nuclear science symposium; Orlando, FL, USA (31 Oct 1984).

The performance of large-scale semiconductor detector systems is assessed with respect to their theoretical potential and to the practical limitations imposed by processing techniques, readout electronics and radiation damage. In addition to devices which detect reaction products directly, the analysis includes photodetectors for scintillator arrays. Beyond present technology we also examine currently evolving structures and techniques which show potential for producing practical devices in the foreseeable future.

4403 Miscellaneous Instruments

REFER ALSO TO CITATION(S) 25334, 25920, 25923, 25954, 26008

26122 (CONF-8506246—1) Real-time in-situ refractometer for concentration measurements in absorption machines. Bostick, D.A.; Klatt, L.N.; Strain, J.E.; Perez-Blanco, H. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 45p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86006074.

From American Society of Heating, Refrigerating, and Air-Conditioning Engineers symposium on advances in heat activated machines; Portland, OR, USA (22 Jun 1985).

As in-situ, real-time refractometer has been developed for the measurement of absorbent concentration in absorption machines. the refractive index of the absorber fluid is determined by measuring light loss from optical fiber cables which are immersed in the solution. The optical fibers have been modified by removing a portion of the cladding from the center of hard clad fiber optics to expose a segment of the core. The exposed portions of the fiber cores are placed at points within an absorption machine for which the measurement of absorbent concentration is desired. The entrance face of all modified fibers is illuminated with a light source. The amount of light lost from the core of each fiber to the absorber solution surrounding the fibers is measured and is directly related to the refractive index of the solution. Because the refractive index of a solution is a function of temperature, a thermocouple junction is placed adjacent to each of the exposed fibers to measure and compensate for local solution temperature.

26123 (JINR—8-85-291) Multichannel automatic device for measuring ultralow temperatures. Neganov, A.B. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1985. 5p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE86701438.

A 16-channel automatic device for carbonic termistor resistance measurements is described. It provides the measurement of 20 Ohm up to 200 kOhm resistances in four automatically selected subranges at heat release in the termistor of 10^{12}-1+ ^{15}W. The data from 6 thermometers are recorded onto self-recorder tape and put out on digital display. Resistance measurement accuracy is not worse than 0.5% The device has remote control and parallel interfaces.

26124 (K/AIS—5005) Issues in developing a distributed data acquisition and control system. Manges, W.W. (Oak Ridge National Lab., TN (USA)). 1986. Contract AC05-84OT21400. 4p. (CONF-860479—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE86005491.

From 18. Southeast symposium on system theory; Knoxville, TN, USA (7 Apr 1986).

This paper discusses issues and implications in the development of a minicomputer-based, distributed intelligence data acquisition and control system to support complex experimental facilities. Atomic Vapor Laser Isotope Separation is typical of programs that require the large-scale experimental facilities that have led to the design philosophy described in this paper. Incorporating computer systems in the instrumentation of ORNL's experimental facilities has increased productivity. However, several challenging issues must be addressed in developing such systems: (1) scientific as well as engineering goals; (2) ultimate goals with intermediate capabilities; (3) budget, scope, and schedule fluctuations; and (4) overlapping maintenance and development. the techniques and philosophy used to provide the computer system hardware, software, architecture, and interfaces for the instrumentation and control system for large-scale developmental facilities were developed for use at ORNL, but can be related to developing any large-scale experimental facility.

26125 (LBL—20135) Multilayer reflectors for the extreme ultraviolet spectral region. Kortright, J.B. (Lawrence Berkeley Lab., CA (USA)). Aug 1985. Contract AC03-76SF00098. 17p. (CONF-850734—22). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86008374.

From 2. international synchrotron radiation instrumentation conference; Stanford, CA, USA (29 Jul 1985).

Reflectivity data from Al-Nb multilayers in the 300 to 450 A wavelength range at angles 20 to 50 deg from normal incidence are presented. Constructive interference between the 10 layer-pairs of this structure is observed. Multilayers deposited on a super-polished optical flat had a much higher reflectivity than those deposited on Si (111) wafers. Annealing multilayers on Si at 330°C for 3 hr further reduced their reflectivity. Measured peak reflectivities for the multilayer on the super-polished optical flat are 17% and less depending on the angle of incidence. The measured reflectivity is not more than half of that calculated using a model assuming sharp interfaces between elemental materials. The resolution of this device, $\lambda/\Delta\lambda \approx 6$ to 7, is in good agreement with the calculated values.

26126 (PB—86-130234/XAB) Metrology for electromagnetic technology: a bibliography of NBS (National Bureau of Standards) publications. Kline, K.E.; DeWeese, M.E. (National Bureau of Standards, Boulder, CO (USA). Electromagnetic Technology Div.). Jul 1985. 70p. (NBSIR—85/3029). NTIS, PC A04/MF A01.

The bibliography lists the publications of the personnel of the Electromagnetic Technology Division of NBS in the period from January 1970 through December 1984. A few earlier references that are directly related to the present work of the Division are included.

26127 (SAND—85-2086C) Novel reentry vehicle instrument - the photodiode. Blodgett, S.R.; Conrad, B.T.; Shrock, K.W.; Wilken, A.C.; Sterk, M.W.; Chaffin, R.J. (Air Force Ballistic Missile Office, Norton AFB, CA (USA); Sandia National Labs., Albuquerque, NM (USA)). 1986. Contract AC04-76DP00789. 12p. (CONF-8604115—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86006234.

From 3. flight testing conference; Las Vegas, NV, USA (2 Apr 1986).

Photodiodes are used as detectors to provide a simple, inexpensive, and reliable method of obtaining data pertaining to reentry vehicle flight performance. These devices are used primarily to measure boundary layer transition onset, but can also measure vehicle roll rate and roll position. This paper will describe the instrument, construction details, installation, cost, and advantages, and will conclude with supporting flight data.

26128 (SAND—86-0297C) Atom-probe field ion microscopy. Kellogg, G.L. (Sandia National Labs., Albuquerque, NM (USA)). 1986. Contract AC04-76DP00789. 27p. (CONF-860397—1). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86008403.

From March forum of the SSSC and CAMS of the National Research Council; Washington, DC, USA (10 Mar 1986).

The atom-probe field ion microscope is an instrument with the ability to image individual atoms on a solid surface, to remove these atoms in a controlled, layer-by-layer, fashion, and to determine the chemical identity of the atoms as they are removed. The atom-prove field ion microscope is described, and selected applications of the technique in surface science are discussed. Applications in the areas of surface diffusion of single atoms and reconstruction of solid surfaces are discussed. Also discussed is the atom-probe mass spectrometer - an extension of the field ion microscope which allows determination of the chemical identity of atoms observed in the field ion microscope. A brief description of several different types of atom-probes is given. Applications are discussed, emphasizing surface chemical reactions, in particular, surface chemical reactions important in catalysis. (LEW)

26129 (SAND—86-0498C) Progress in the design of optical fiber sensors for the measurement of pulsed electric currents. Day, G.W.; Veeser, L.R.; Chandler, G.I.; Cernosek, R.W. (National Bureau of Standards, Boulder, CO (USA); Los Alamos National Lab., NM (USA); Sandia National Labs., Albuquerque, NM (USA)). 1986. Contract AC04-76DP00789. 13p. (CONF-860384—6). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86007831.

From Conference on measurement of electrical quantities in pulse power systems-II; Gaithersburg, MD, USA (5 Mar 1986).

The state of the art in the design of fiber sensors for pulsed electric currents is reviewed. Some of the more useful configurations are described and compared. Transfer functions are computed and used to illustrate the effect of linear birefringence and twisting on the characteristics of the sensors. The technique of annealing bend-induced birefringence is described and its present capabilities indicated. An analysis of the ultimate limits to noise equivalent current is given, indicating that several orders of magnitude improvement should be obtainable.

26130 In situ particle size measurements using a two-color laser scattering technique. Wang, J.C.F.; Hencken, K.R. (Sandia National Laboratories' Livermore, California 94550). *Applied Optics;* **25**: No. 5, 653-657(1 Mar 1986).

We have developed a technique using light scattered from individual particles in the near-forward direction to measure particle size in the range of 10-200 μm. This technique uses the Mie scattering theory to relate the measured light intensity to particle size based on calibration techniques employing pinholes and water droplets of known size. We have applied a unique two-color optical arrangement to minimize the edge effect which can cause incorrect size measurements for particles that pass through the edge of the laser beam focal volume. In this paper we describe our experimental technique and the results of size measurements obtained with this technique for water droplets and pulverized coal particles.

26131 Trace gas detection by laser intracavity photothermal spectroscopy. Fung, K.H.; Lin, H.h. (Brookhaven National Laboratory, Department of Applied Science, Environmental Chemistry Division, Upton, New York 11973). *Applied Optics;* **25**: No. 5, 749-752(1 Mar 1986). Contract AC02-76CH00016.

A novel laser intracavity photothermal detector is described. In this scheme, sample absorption of the pump laser power takes place within the cavity of a probe He-Ne laser causing modulation in the gain and in turn the output power. Comparison of this intracavity detector with two other photothermal techniques, namely, phase fluctuation optical heterodyne spectroscopy and thermal beam deflection, is made in terms of practicality and sensitivity. For in situ measurements, sensitivity of 0.5 x 10^{-7} cm^{-1} for a probe length of 3 cm has been achieved.

26132 Multilayer mirrors for x rays and the extreme UV. Underwood, J.H. (Center for X-ray Optics at Lawrence Berkeley Laboratory in Berkeley, California). *Optics News;* **12**: No. 3, 20-25(Mar 1986).

The history, fabrication, and uses of multilayer reflectors for x radiation and far ultraviolet radiation are reviewed. (AIP)

45 EXPLOSIONS AND EXPLOSIVES

4501 Chemical

REFER ALSO TO CITATION(S) 25802, 25944, 26146

26133 (AD-A—163274/4/XAB) Simulation development for Silo Test Program (STP). Volume 1. Design and evaluation of a variable HEST (high explosive simulation technique) for STP 3.5A experiment. Technical report, 11 January 1982-31 March 1984. Sanai, M.; Colton, J.D. (SRI International, Menlo Park, CA (USA)). 31 Mar 1984. 107p. NTIS, PC A06/MF A01.

In support of the Defense Nuclear Agency (DNA) Silo Test Program (STP), variable high-explosive simulation technique (HEST) was designed and evaluated to simulate the airblast environment resulting from a 1.95-kt (1/8-scale of 1 MT) nuclear surface burst over a pressure range of 500 MPa (5 kbar) to 7 MPa (1000 psi). The final design consisted of a variable HEST in which Iremite-60 explosive is used predominantly in the pressure range from 500 to 100 MPa, and 0.085 kg/m (400 grain/ft) primacord explosive is used in the pressure range from 100 to 7 MPa. The overburden height increases linearly with range from 0.64 to 1.15m. The cavity height increases linearly with the range from 38 mm at the 500-MPa location to 70 mm at the 35-MPa location. Beyond this point, the cavity height remains constant at 70 mm. The HEST simulator was used in the STP 3.5A experiment performed by WES at Fort Knox. On the basis of photopole, airblast, and near-surface soil-stress gage data, the impulse from the HEST agreed, to within measurement error, with the design goals for both short (10 ms) and long (90 ms) time frames. Hence, the full positive phase of a 1.95-kt surface burst was successfully simulated by the HEST.

26134 (LA—10657-MS) Bistatic phase sounding in the ionosphere above the Minor Scale explosion. Fitzgerald, J. (Los Alamos National Lab., NM (USA)). Feb 1986. Contract W-7405-ENG-36. 27p. NTIS, PC A03/MF A01; GPO Dep. File Number DE86008582.

A 4.8-kT chemical explosion named Minor Scale was detonated at the White Sands Missile Range on June 26, 1985. Following the detonation, three bistatic HF phase sounders observed dis-

turbances in the ionosphere directly over the explosion. The path from transmitters to receivers, which were 283 km apart, had a midpoint 7 km northeast of ground zero. We describe the experiment and present time histories of the power spectra of the three transmission. Between 300 and 360 s after the explosion, all three links showed changes in spectra. The lowest frequency shifted by -1 Hz, indicating the passage of the acoustic wave from the explosion through the total reflection height in the E-layer at about 95 km. We model the Doppler shift and absorption change to be expected for this disturbance assuming the acoustic wave had an N-wave profile with a maximum amplitude of 15%. The spectra of the lowest frequency also show temporary peaks at negative Doppler that indicate partial reflection modes from upper and lower edges of the N-wave. We calculate the Doppler shift and reflection coefficients for these partial reflection modes. During the same time period, the spectra of the two higher frequency transmissions also showed temporary peaks at negative Doppler that rapidly changed their frequency offset. From 380 to 480 s after the explosion, broad peaks at negative Doppler shift appeared in the spectra of the two higher frequencies. These peaks could be caused by reflection in the F-region induced by a temporary increse in the critical frequency by the passage of the acoustic wave from the explosion. We calculate the Doppler shift to be observed from such a mode. 11 refs., 10 figs.

26135 (LA-UR—86-378) Progress in the theory of fragmentation and analysis of XDT. Dienes, J.K. (Los Alamos National Lab., NM (USA)). 1986. Contract W-7405-ENG-36. 7p. (CONF-860365—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86006040.

From Propulsion systems hazard meeting; Monterey, CA, USA (6 Mar 1986).

The two principal mechanisms for hot spots generated in XDT are thought to be shear cracking and shear banding. Casual observation would not be sufficient to distinguish between the two in dynamic processes, since in either case a molten zone will develop rapidly and govern the ensuing behavior. The approaches to stability analyses are, however, very different for the two phenomena. Classically, cracking is treated as a two-dimensional problem in linear elasticity. Though nonlinear elastic and elastic-plastic solutions are being investigated by a number of researchers, the underlying idea in all these approaches is to find a critical state in which an increment in surface energy is just balanced by a corresponding decrement in elastic energy, and the elastic energy is obtained from a solution of the appropriate linear boundary-value problem. On the other hand, shear-banding is treated analytically as a one-dimensional process in which strain-hardening just balances thermal-softening in the critical state, both kinds of behavior involving nonlinear material response. A more general type of analysis, which subsumes these two idealizations as special cases, would be of interest, and help us to understand the role of the various processes contributing to rapid localized shear. Analysis of the general problem by analytic methods may well be intractable, but numerical methods can be used to obtain useful insights. The SCRAM code, which was developed for macroscopic studies of XDT, can also be used for the analysis of individual hot-spots on a microscopic scale with the void opening algorithms used to represent the process zone usually found in the neighborhood of a crack tip, though no such effort is currently planned. 14 refs., 3 figs.

4502 Nuclear

REFER ALSO TO CITATION(S) 26812

26136 (AD-A—162535/9/XAB) Obstacles as probes of the blast wave interior in the NRL laser/HANE simulation experiment. Memorandum report. Giuliani, J.L. (Naval Research Lab., Washington, DC (USA)). 6 Dec 1985. 36p. (NRL-MR—5671). NTIS, PC A03/MF A01.

It is proposed that small obstacles be placed in the path of the expanding blast wave to probe the dynamics of the interior cavity formed after a laser-target interaction. The theory of attached and detached shocks for cones and spheres in supersonic streams is briefly reviewed. Graphs of the results for a ratio of specific heat gamma = 1.2 and 5/3 are presented for estimating the local Mach number in the cavity from the experimental results. It is also suggested that theoretical and numerical models of the experiment predict the temporal evolution of the bow-shock stand-off distance for a blunt obstacle. A direct comparison with the experiment can then verify or rule out the competing models.

26137 (AD-A—162705/8/XAB) FOURFIT - a computer code for determining equivalent nuclear yield and peak overpressure by a Fourier spectrum fit method. Technical report, 1 May 1983-29 February 1984. Steedman, D.W.; Partch, J.C. (Applied Research Associates, Inc., Albuquerque, NM (USA)). 25 May 1984. 162p. NTIS, PC A08/MF A01.

A computer code is presented that performs least squares fitting of simulated airblast pressure Fourier amplitude spectra. The code iteratively determines the simulated nuclear yield and peak overpressure of a record by the FOURFIT method of analysis by comparing the data spectra to the spectra representing candidate fits.

26138 (AD-A—162944/3/XAB) Nuclear weapon effect research at PSR (Pacific-Sierra Research Corporation) - 1983. Volume 8. Effect of shock-induced ground conductivity on Kratz particle velocity gauge. Final technical report, 27 October--30 November 1982. (Pacific-Sierra Research Corp., Los Angeles, CA (USA)). 28 Sep 1984. 34p. (PSR—1422-VOL-8). NTIS, PC A03/MF A01.

This report details the effect of shock-induced conductivity on the operation of the Kratz velocity gauge, which measures the ground-particle velocity induced by the shock wave due to a large-yield high-explosive or underground nuclear detonation. Such shock waves are typically strong enough to induce significant ground conductivity, which can affect the operation of the gauge. Three models of increasing fidelity to the physics of the advancing conductivity front are presented and analyzed. Numerical results indicate that, for typical gauge-parameter values, shock-induced ground conductivities of 100 mhos/m or less do not affect gauge response.

26139 (AD-A—162946/8/XAB) Tactical sensors for dispersed TNF (tactical nuclear force) units. Appendix 1. Tactical sensory survey. Technical report, 2 February 1982-30 June 1983. Antsen, P.; Burgett, L.; Chamberlin, J.; Rapaport, B. (Science Applications International Corp., McLean, VA (USA)). 30 Jun 1983. 389p. NTIS, PC A17/MF A01.

This Appendix presents the results of the tactical sensor survey conducted in the performance of contract DNA 001-82-C-0057. The Appendix includes a data sheet and relevant product literature for each tactical sensor or sensor system identified.

26140 (AD-A—163137/3/XAB) Radiac instruments and film badges used at atmospheric nuclear tests. Technical report, 15 February-26 September 1985. Brady, W.J.; Nelson, A.G. (JAYCOR, Alexandria, VA (USA)). 26 Sep 1985. 85p. NTIS, PC A05/MF A01.

This report is part of the Nuclear Test Personnel Review. It summarizes, for the period 1945-1962, those radiac instruments, pocket dosimeters, and film badges used by participants at atmospheric tests. It also includes the accuracy of each, where documentation can be found, or estimates of accuracy based on similar equipment and badges.

26141 (AD-A—163218/1/XAB) Aircraft nuclear-survivability methods. Doctoral thesis. Undem, H.A. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA). School of Engineering). Sep 1985. 279p. (AFIT/DS/PH—84-3). NTIS, PC A13/MF A01.

This research presents a new approach for assessing the survivability of aircraft components in nuclear blast and thermal environments is presented. A nonparametric technique is developed for use in calculating the reliability interference integral. This approach eliminates the need for density function identification and parameter estimation. Furthermore, the method can be used without resorting to large-sample random Monte Carlo simulation or propagation of moments. In addition to this, the derived cumulative distribution function using such a technique exactly interpolates the true distribution function at selected points. The method is applied to the

problem of aricraft survivability in nuclear blast environments using failure (strength) distributions found in the literature. It is also applied to the case of aircraft survivability in nuclear thermal environments where direct failure data is not available. Inputs to the engineering models involved are treated statistically and the method is used to rigorously determine the statistical nature of the output variables.

26142 (CONF-850953—Vol.2) Third symposium on containment of underground nuclear explosions. Volume 2. Proceedings. Olsen, C.W.; Donohue, M.L. (eds.). (Lawrence Livermore National Lab., CA (USA)). 1985. Contract W-7405-ENG-48. 432p. NTIS, PC A19/MF A01; 1; GPO Dep. File Number DE86008380.

From 3. symposium on containment of underground nuclear explosions; Idaho Falls, ID, USA (10 Sep 1985).

Volume two contains twenty nine papers which are grouped under the following subject headings: (1) structural geology; (2) geology, stratigraphy, and geologic data bases; (3) materials modeling; (4) containment calculations; (5) logging; (6) geophysical techniques; and (7) phenomenology. All papers have been processed for inclusion in the Energy Data Base. (ATT)

26143 (UCRL—15770) Barometric pressure transient testing applications at the Nevada Test Site. Nuclear chimney analysis. Final report. Hanson, J.M. (Hanson and Associates, Salt Lake City, UT (USA)). Dec 1985. Contract W-7405-ENG-48. 317p. NTIS, PC A14/MF A01; 1; GPO Dep. File Number DE86008138.

Investigations of barometric pressure testing of NTS nuclear chimneys were reviewed. This review includes the models used in the interpretation, methods of analysis, and results. Analytic and semi-analytic models were presented and applied to both historical data and new data taken for this current project. An interpretation technique based on non-linear least squares methods was used to analyze this data in terms of historic and more recent chimney models. Finally, a detailed discussion of radioactive gas transport due to surface barometric pressure fluctuations was presented. This mechanism of transport, referred to as "barometric pumping," is presented in terms of conditions likely to be encountered at the NTS. The report concludes with a discussion of the current understanding of gas flow properties in the alluvial and volcanic areas of the NTS, and suggestions for future efforts directed toward increasing this understanding are presented.

26144 (UCRL—92456) Static and dynamic mechanical properties tests of core material from hole U8j at the Nevada Test Site. Anderson, G.D.; Kusubov, A.S. (Lawrence Livermore National Lab., CA (USA)). 27 Jan 1986. Contract W-7405-ENG-48. 18p. (CONF-850953—22). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86008387.

From 3. symposium on containment of underground nuclear explosions; Idaho Falls, ID, USA (10 Sep 1985).

Core samples were obtained from Hole U8j at the Nevada Test Site. The cores were from depths of 494 m (Fraction Ash Flow Tuff) and 427 m (Altered Bedded Tuff). Quasi-static triaxial tests were performed at a strain rate of 10^{-4}/s at confining pressures from 0.1 to 300 MPa on material that retained the in-situ integrity and water content. The failure strength, defined as the difference in principal stresses at failure, of the material from 494 m increased from 9.7 MPa to over 90 MPa while that of the material from 427 m increased from about 10 MPa to over 300 MPa, over the range of confining pressures applied. The longitudinal strains at failure ranged from 2 to 7%. Dynamic high-strain-rate tests (10^{4}/s-10^{5}/s) were performed on solid core samples and on wet and dry reconstituted samples of the material from 494 m depth. These tests were flat impact tests using a gas gun and magnetic particle velocity gauges to look for dynamic strength effects. The shock wave stress regime was 250 to 1270 MPa. No wave structure indicative of dynamic yielding was observed in the reconstituted samples. However, a wave structure was observed in the core material. Interpreting this wave structure as dynamic failure and using a value of Poisson's ratio from ultrasonic data to compute the transverse stress, the data suggest a dynamic failure strength of unfractured material under uniaxial strain about 35% higher than that observed quasi-statically at comparable confining pressures. The absence of dynamic yielding in reconstituted samples suggests that the lower limit dynamic failure stress for reconstituted material is below 100 MPa. 5 refs., 7 figs., 5 tabs.

4503 Explosion Detection

26145 (SAND—85-1243) Regional Seismic Test Network research symposium proceedings, April 30-May 1, 1985. Breding, D.; Nakanishi, K. (Sandia National Labs., Albuquerque, NM (USA)). Feb 1986. Contract AC04-76DP00789. 363p. NTIS, PC A16/MF A01; 1; GPO Dep. File Number DE86007986.

17 papers were presented covering engineering evaluation, detection/location, site characterization, yield determination, signal characterization, and teleseimic body waves. All of the papers were linked by the common RSTN database. Separate abstracts were prepared for the individual presentations. (ACR)

50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC

5001 Basic Studies

REFER ALSO TO CITATION(S) 25758, 26356

26146 (AD-A—162691/0/XAB) Spectroscopic, kinetic, and dynamic experiments on atmospheric species. Final report, 1 October 1982-30 September 1984. Miller, S.M.; Lurie, J.B.; Armstrong, R.A.; Winkler, I.; Steinfeld, J.I. (Air Force Geophysics Lab., Hanscom AFB, MA (USA)). 21 Mar 1985. 252p. (AFGL-TR—85-0077). NTIS, PC A12/MF A01.

This final report contains: results of COCHISE (Cold Chemical Infrared Simulation Experiment) experiments involving the interaction of N_3 with CO, O_3(v) with N_3 and the fluorescences of NO and N_3; a theoretical discussion of O_2/Ar and N_2/Ar microwave discharges; trajectory calculations involving the collisional relaxation of high vibrational-rotational states of O_3 by Ar; experimental determination of the intramolecular branching ratio of the (021) and (101) combination bands of CO_2; determination of the distribution of vibration sites of NO(v) from the reaction N(4S) + O_2 yield NO(v) via multiphoton ionization; FAKIR (Flowing Atmospheric Kinetic Infrared Experiment) measurements of atomic oxygen production in the reaction between N(2D) and CO_2 and the quenching of N(2D) by atomic oxygen; and both the visible and infrared fluorescence results from the LINUS (Laser Infrared Nuclear Simulation) project.

26147 (DOE/MC/16454—T14) Aerosol deposition in horizontal sampling tubes. Stenger, J.B. (West Virginia Univ., Morgantown (USA). Dept. of Mechanical and Aerospace Engineering). 1985. Contract AT21-81MC16454. 252p. NTIS, PC A12/MF A01; 1; GPO Dep. File Number DE86008040.

The deposition from an aerosol within a horizontal sampling tube was studied over a range of sampling speeds to investigate the mechanisms of deposition and to quantify the mass and size distributions of the particles deposited. Measurements of deposition were made by lining a sampling tube with aluminum foil to collect the deposition. The aerosol consisted of solid particles ranging from 2 μm to 32 μm in diameter. Tests were conducted over a range of sampling tube Reynolds numbers from 1500 to 8000. Computer models were formulated to describe the deposition process by considering gravity, developing laminar and turbulent boundary layers, Stokes drag, and Saffman and Magnus lift. The results showed entrance effects to be important in the deposition process. The measured deposition in the entrance region of the sampling tube was less than the predicted deposition, indicating that the uniform entrance velocity assumption used in the models does not represent the actual sampling conditions. At high Reynolds numbers, less deposition was measured throughout the sampling tube than was predicted. This result was caused by a scouring of the particles from the tube wall by the turbulence of the flow, which was not included in the models. A correlation was obtained from the results of the

measurements that adequately predicts deposition in the laminar and near-laminar flow regimes. 46 refs., 66 figs., 8 tabs.

26148 (UCRL—93488) Results of comparison studies of infrared radiative transfer models. Luther, F.M. (Lawrence Livermore National Lab., CA (USA)). Feb 1986. Contract W-7405-ENG-48. 11p. (CONF-860562—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE86006531.

From 6. conference on atmospheric radiation; Williamsburg, VA, USA (12 May 1986).

The capability to accurately model the natural and perturbed climate is important to the understanding of current-related issues. It is important that all the major physical processes and feedback mechanisms in climate models be evaluated as to their accuracy and limitations. Since the transfer of solar and longwave radiation represents the prime physical process that drives the circulation of the atmosphere and its temperature structure, an evaluation of the modeling of radiative processes is a critical element in the overall evaluation of the models. This paper discusses model comparison studies of infrared radiative transfer models that have been conducted for the purpose of validating and improving these models. 18 refs., 7 tabs.

26149 Trace gases and other potential perturbations to global climate. Wang, W.; Wuebbles, D.J.; Washington, W.M.; Isaacs, R.G.; Molnar, G. (Atmospheric and Environmental Research, Incorporated, Cambridge, Massachusetts). *Reviews of Geophysics and Space Physics;* **24**: No. 1, 110-141(Feb 1986).

We review the various natural and anthropogenic factors that may affect the climate. The purpose is to summarize our understanding of these factors and their potential future climatic effects so that CO_2-induced climate change can be viewed in a proper context. The factors we discuss include trace gases, anthropogenic and volcanic aerosols, variation of solar constant, change of surface characteristics, and releases of waste heat. We discuss the origins of the various natural and anthropogenic perturbations, the physical and chemical processes and their interactions, model sensitivity calculations, and model projections of their potential future climatic effects. The discussions center on trace gases because of their potentially large climatic effects. It appears that the increases of atmospheric trace gases of other kinds in addition to CO_2 could have important climatic effects. The model calculations suggest that the combined effect of these other trace gases, and the associated change of atmospheric ozone and water vapor distributions, could potentially warm the climate by an amount comparable in magnitude to the effect of doubling the CO_2. Aerosols of anthropogenic origins may have substantial effects on regional climate, while the volcanic aerosols may have an effect on large-scale climate for up to a few years after injection. Changes of surface characteristics and releases of waste heat may also have substantial effects on the regional climate, but these effects are most likely to be small when compared with the effect of CO_2 increase. Changes of solar constant could have an effect on the global scale, but the time scale is much longer. There is much more that needs to be learned with regard to the above mentioned natural and anthropogenic factors that may affect the climate. A brief summary of those needs is presented.

5002 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 25300, 25301, 25304, 25306, 25307, 25323, 25537, 25775, 25820, 25822, 25837, 25838, 25839, 25840, 26272, 26290, 26313

26150 (AD-A—161880/0/XAB) Survey and evaluation of field data suitable for smoke hazard model evaluation. Technical report, 1984-1985. Policastro, A.J.; Dunn, W.E. (Argonne National Lab., IL (USA)). Sep 1985. 68p. (ANL/ER—85-3). NTIS, PC A04/MF A01.

This report presents a summary and critical evaluation of the existing data on the dispersion of military smokes. Emphasis is placed on fog oil smokes in terms of the measurement of concentration, dosage, particle size distribution, and mass deposition rate. The suitability of the available data for evaluating atmospheric dispersion models for health and environmental impacts purposes is marginal. Several questions remain as to the adequacy of the sampling techniques used and the validity of some of the supporting meteorological data. The best of the existing data on fog oil smoke dispersion were acquired during the Smoke Week III and IV experiments.

26151 (AD-A—163119/1/XAB) HCl monitor. Phase 1. Final report, 19 September 1984-19 March 1985. Bernstein, L.S.; Matthew, M.W.; Bien, F. (Spectral Sciences, Inc., Burlington, MA (USA)). Dec 1985. 35p. (TR—74). NTIS, PC A03/MF A01.

Because of potential environmental effects from the large quantities of HCl released into the atmosphere from Space Shuttle launches, it is important to monitor the transport of HCl in both vapor and aerosol form into the surrounding areas. During Phase I of the Air Force 19834-1985 SBIR program, Spectral Sciences, Incorporated investigated the feasibility of developing a man-portable HCl monitor capable of unattended operation. The major Phase I objectives were to experimentally demonstrate a novel infrared light source and to design and HCl monitor, based on the new infrared source, which should be built and field tested in Phase II. The spectral output of the HCl infrared lamp was measured and was found to be consistent with earlier theoretical predictions. This HCl lamp was used in conjunction with a room-temperature HCl absorption cell to demonstrate the potential sensitivity of the approach to measure small ambient HCl concentrations. Even with the relatively crude nature in which the emission-absorption measurements were made, the authors were able to demonstrate detectable absorption down to 2 ppm for a field instrument. With the improved HCl lamp design and the real time self calibrating optical layout presented in this proposal, it is felt that ambient HCl concentrations as low as 0.1 ppm can be detected with the Phase II instrument.

26152 (AD-A—163232/2/XAB) Microcomputer pollution model for civilian airports and air force bases. User's guide. Segal, H.M.; Kemp, J.K.; Hamilton, P.L. (Federal Aviation Administration, Washington, DC (USA). Office of Environment and Energy). Dec 1985. 55p. (FAA-EE—85-4). NTIS, PC A04/MF A01.

Over the past five years, the Federal Aviation Administration and the United States Air Force have developed a number of user-friendly emissions and dispersion models for air-quality assessment purposes. The first, Simplex A was completed in July 1981. The second, called Emissions and Dispersion Modeling System (EDMS), has just been completed and this report constitutes its User's Guide. First, this User's Guide shows how the EDMS system evolved from the earlier, more complex AVAP and AQAM systems. Then, it identifies the hardware and software required to run the system and provides instructions on how to add, delete or change standard information. Finally, through a 125-step example problem, it instructs the user on how to input and process data to produce: (1) an emissions inventory of all sources at an airport/airbase, and (2) an estimate of the concentrations of these sources at specified locations. An inexperienced user should be able to process the example problem in less than three hours.

26153 (BNL—36875) Acid deposition: a national problem. Hendrey, G.R. (Brookhaven National Lab., Upton, NY (USA)). 1985. Contract AC02-76CH00016. 15p. (CONF-8306288—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE86007810.

From Acid deposition: environmental, economic, and policy issues; Plattsburgh, NY, USA (10 Jun 1983).

The deposition of excessive quantities of sulfur and nitrogen from the atmosphere constitutes a problem encompassing all of the United States east of the Mississippi River. It also occurs in some areas of the western US. Calculations based on emission inventories and simplifying assumptions indicate electric utilities account for 66% of SO_2 emissions, 29% of NO/sub x/ emissions and about half of precipitation acidity. Acidification of clearwater lakes and streams is a widespread problem only in areas receiving rain with an average acidity $\leq$ 4.7. The dominant anion in such waters is SO_4^{2-} and concentrations of aluminum derived from watershed acidification may exceed 200 $\mu g\ l^{-1}$. Changes in assemblages of aquatic biota become increasingly apparent as pH decreases below 6.0, and elimination of fish from some waters has been documented.

The sensitivity of surface waters is controlled by and represents an integration of biogeochemical processes in their edaphic settings. Changes in surface water chemistry imply changes in the terrestrial environment. Direct evidence of changes in terrestrial environments is sparse. Nevertheless, observations of forest dieback in the US and abroad suggest that acid deposition may contribute to the problem. Very few credible studies are available which allow an evaluation of acid precipitation effects on crops.

26154 **(BNL—37346) Chemical instrumentation for field studies of atmospheric wet deposition processes.** Tanner, R.L. (Brookhaven National Lab., Upton, NY (USA)). Nov 1985. Contract AC02-76CH00016. 8p. (CONF-860425—10). NTIS, PC A02/MF A01; GPO Dep. File Number DE86005255.

From 191. American Chemical Society national meeting; New York, NY, USA (13 Apr 1986).

Field studies of wet deposition processes require the differentiation and determination of many trace reactive species in the atmosphere. These species may be present in clear-air gaseous or aerosol phases, or they may be distributed between cloudwater or precipitation and interstitial gaseous phases. Analytical requirements on existing techniques have been extremely rigorous and, in several cases, have required development of new approaches to the sampling and determination of critical species. This paper reviews these developments with respect to airborne sampling in the all general areas.

26155 **(CONF-860425—8) Negative ion processes for the unambiguous identification of polycyclic aromatics.** Buchanan, M.V.; Wise, M.B. (Oak Ridge National Lab., TN (USA)). 1986. Contract AC05-84OR21400. 8p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86004760.

From 191. American Chemical Society national meeting; New York, NY, USA (13 Apr 1986).

Recently, we have been investigating the use of electron capture negative ion processes for the differentiation of isomeric PAH. Most PAH have positive electron affinities ranging in magnitude from a few tenths to over one electron volt. Electron capture reactions of PAH using both electron capture chromatographic detectors and negative ion chemical ionization mass spectrometry have been reported. In this paper, negative ion processes have been investigated for the differentiation of isomeric PAH based upon relative differences in electron affinities. The use of these processes in both negative ion chemical ionization mass spectrometry and a newly developed chromatographic detector will be discussed.

26156 **(DOE/CE/15125—T1) Chemical method for removal of sulfur dioxide from stack gases. Final report.** Tung, S.E. (Tung (Shao-E.), Brookline Hill, MA (USA)). May 1985. Contract FG01-82CE15125. 31p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86005676.

Flue gas desulfurization has a positive side; it affords a means to recover some valuable sulfur chemicals. The elemental sulfur market has been extremely tight in recent years, because the nation will run out of uncombined sulfur in the foreseeable future and because the energy needed to make hot water required in the Frash mining operation has become increasingly more expensive. In the past, the regenerative FDG processes are generally too expensive for practical application. Under DOE's Invention and Small Scale technology branch sponsorship, we have developed a new process which can: save the steam requirement for SO_2 regeneration by ten (10) fold, and slash the equipment cost to about 60% of that of the other comparable regenerative processes. This new FDG process is cheaper to operate than the Limb process generally and much cheaper to use under favorable conditions. Widespread application of this emerging technology could result in a significant saving in cost to the nation in its effort to abate acid rain. While the estimation on the magnitude of this saving can't be precise at the present time, it could potentially exceed one billion dollars annually. In addition, the technology will recover a valuable resource (sulfur), save a valuable resource (limestone) and generate no solid waste.

26157 **(DOE/OR/21400—T248) ORNL indoor air quality research status and review.** (Oak Ridge National Lab., TN (USA)). 15 Jan 1986. Contract AC05-84OR21400. 99p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE86007855.

Slides used to present the status and experiment parameters for the interagency project are compiled in this report. (PSB)

26158 **(DOE/PC/60263—1) Evaluation of the SULF-X flue gas SO/sub x//NO/sub x/ removal process.** Blake, D.O.; Venkateswaren, S.R. (NUS Corp., Gaithersburg, MD (USA)). Dec 1985. Contract AC22-83PC60263. 199p. NTIS, PC A09/MF A01; 1; GPO Dep. File Number DE86006282.

This report summarizes the various state and federal government sponsored research and development programs conducted by Pittsburgh Environmental Systems (PENSYS) to demonstrate the effectiveness of their SULF-X Process to simultaneously remove SO_2 and NO/sub x/ from coal fired boiler flue gases. Although early development work appeared promising the objective to simultaneously remove at least 90% SO_2 and NO/ sub x/ at the 1.5 MW capacity Western Center Hospital test facility was not reached. Economic and technical comparisons are made with other flue gas clean up systems at the 500 MW scale to assess the processes reliability in the commercial market. The conclusions drawn were that the process was not viable at its present stage of development and that extensive research and development would be needed to identify and understand the complex reactions that occur when the process is scaled up to and uses commercial components and equipment.

26159 (KFK-PEF—2, pp 1-15) **Assessment of forest damage by remote multispectral photography.** Kadro, A.; Kuntz, S.; Kim, C. (Freiburg Univ., Germany, F.R. Abt. Luftbildmessung und Fernerkundung). Apr 1985. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86751479. (CONF-8503225—).

From 1. status colloquium of the European Research Center project for air pollution abatement measures (PEF) of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (5 Mar 1985).

This paper presents an investigation of spectral reflection properties of forest vegetation, esp. in reference to the difference between healthy and damaged trees and stands. The investigation is based on the evaluation of multispectral data in the spectral regions of visual, near IR and middle IR of the electromagnetic spectrum. Data were collected from different flight altitudes. A computer-aided classification for forest stand damage inventory is also presented and discussed.

26160 (KFK-PEF—2, pp 17-41) **Effect-related detection of the emission input load of specific forest damage areas in Baden-Wuerttemberg using bio-indicators (active monitoring of indicator plants).** Arndt, U.; Schlueter, C. (Hohenheim Univ., Stuttgart, Germany, F.R. Inst. fuer Landeskultur und Pflanzenoekologie). Apr 1985. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86751479. (CONF-8503225—).

From 1. status colloquium of the European Research Center project for air pollution abatement measures (PEF) of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (5 Mar 1985).

23 measurement stations equipped with bio-indicators were set up in 4 forest-damage areas in Baden-Wurttemberg in the past year of investigation. Those stations held a key position which had automatic measurement stations installed in addition. This allows a comparison of detected effects with measured pollutant concentrations of the atmosphere. However, these correlation studies will have to be shelved for the time being since the data of the automatic measurement stations are not accessible yet. Effect studies performed to-date revealed the North-Eastern slopes of the Black Forest mountain range exposed to the Rhine valley to be subjected to phytotoxic oxidant concentrations. The result of a transsection to the North East stretching from Stuttgart to Wuerttemberger Hof (some 50 km off Stuttgart) showed a maximum of oxidant-caused plant injuries to be expected no nearer to the source than at some 30 km away. These findings agree with those results found by

Steubing and Kirschbaum (1982) for the surrounding area of Frankfurt.

26161 (KFK-PEF—2, pp 313-326) **Identification of chemical-photochemical conversion products of biogenic hydrocarbons with anthropogenic air pollutants.** Stieglitz, L.; Becker, R.; Jay, K. (Kernforschungszentrum Karlsruhe G.m.b.H., Germany, F.R. Inst. fuer Heisse Chemie). Apr 1985. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86751479. (CONF-8503225—).

From 1. status colloquium of the European Research Center project for air pollution abatement measures (PEF) of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (5 Mar 1985).

An experimental procedures was set up for examining chemical and photochemical conversions of α-pinene, β-pinene, myrcene, limones with O_3/NOsub(x)/SO_2. Initial tests were performed involving α-pinene or β-pinene (C. 80 vpm), resp., and ozone (40-240 vpm). Reaction mixtures were analyzed using capillary gas chromatography/mass spectrometry, and identifying pinonic acid (clearly) and pinone aldehyde (suggested structure) as degradation products of α-pinene. Preliminary structures (norpinone, hydroxynorpinone) could be suggested for reaction products of β-pinene.

26162 (KFK-PEF—2, pp 327-337) **Air flow around conifers and its influence on pollutant deposition by microdroplets.** Ruck, B. (Karlsruhe Univ., T.H., Germany, F.R. Inst. fuer Hydromechanik). Apr 1985. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86751479. (CONF-8503225—).

From 1. status colloquium of the European Research Center project for air pollution abatement measures (PEF) of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (5 Mar 1985).

Initial qualitative and quantitative studies on air flows around single trees and on the leeward edge of a model stand allowed an understanding of phenomenological processes. As was expected, tests on airflows around single trees show the interaction between tree and air flow to result in a drastic increase in turbulence values. The LDA measurement method used allows to identify flow characteristics locally thus enabling observations of the coarse and fine structures of turbulence and of exchange values. Porosity and coarse structure of the object and the degree of underflow proved to be particularly influential parameters. Measurements performed leeward of a model stand prove that microdroplets carried along in the air flow are transported by turbulent transport processes into the boundary layer nearest to the ground where they will deposit owing to a lack of convective flows. (orig.).

26163 (KFK-PEF—2, pp 339-352) **Formation of nitrate and sulphate containing particles and droplets in the atmosphere.** Dlugi, R.; Jordan, S.; Manegold, S. (Kernforschungszentrum Karlsruhe G.m.b.H., Germany, F.R. Lab. fuer Aerosolphysik und Filtertechnik 1). Apr 1985. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86751479. (CONF-8503225—).

From 1. status colloquium of the European Research Center project for air pollution abatement measures (PEF) of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (5 Mar 1985).

In 1984/1985, activities concerning the formation of nitrate and sulphate containing particles in the atmosphere focussed on the following items: provision and testing of measurement equipment and techniques, espec. for the reaction products sulphate, nitrate and ammonium; simulation studies on gas oxidation at the surface of aerosols and participation in a TULLA pre-experiment. The gas measurement equipment and technique were available and calibrated. Gaseous acids were separated from their salts using the denuder technique. Acids and salts were tested for using high-pressure liquid chromatography. Simulation experiments allowed to show sulphate formation to be accelerated by NOsub(x) in catalytic SO_2 oxidation on dusts. Both the measurement equipment and techniques for gas and reaction products could be tested for measurements in the open atmosphere during the TULLA pre-experiment.

26164 (KFK-PEF—2, pp 353-371) **Sulphur dioxide mass balance in a region exemplified by Baden-Wurttemberg (TULLA).** Fiedler, F.; Dorwarth, G.; Laudenbach, I.; Walk, O.; Jaeschke, W.; Beltz, N.; Herrmann, J. (Karlsruhe Univ., T.H., Germany, F.R. Inst. fuer Meteorologie und Klimaforschung; Kernforschungszentrum Karlsruhe G.m.b.H., Germany, F.R. Inst. fuer Meteorologie und Klimaforschung; Frankfurt Univ., Germany, F.R. Zentrum fuer Umweltforschung). Apr 1985. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86751479. (CONF-8503225—).

From 1. status colloquium of the European Research Center project for air pollution abatement measures (PEF) of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (5 Mar 1985).

This research project is a contribution to the TULLA measurement campaign (Transport und Umwandlung von Luftschadstoffen im Lande Baden-Wuerttemberg und aus Anrainerstaaten, transport and conversion of air-borne pollutants in Baden-Wuerttemberg and from adjacent countries). It is subdivided into three subtasks: 1) Establishment of atmospheric vertical profiles of wind, temperature and humidity at several measurement sites (partly in co-operation with the Deutscher Wetterdienst and the Geophysikalischer Beratungsdienst der Bundeswehr) in order to determine the dispersion conditions for pollutants in a meso-scale area (c. 200 km x 200 km); 2) Measurement of the concentrations of SO_2, NO, NOsub(x) and a number of other pollutant component by aircraft (subcommissioned by Dr. Jaeschke, Francfort, Prof. Baechmann, Darmstadt and Dr. Paffrath, Oberpfaffenhofen) in order to detect areal distribution and dispersion of concentrations within the open atmosphere; and 3) Development and testing of a mesoscale simulation model allowing to describe turbulent transport above an irregular terrain. Using a number of results of the pre-experiment, the model is shown to furnish calculations agreeing qualitatively with the measurements.

26165 (KFK-PEF—2, pp 373-384) **Close-meshed cadastre of SO_2 and NOsub(x) emissions in Baden-Wuerttemberg and the Upper Rhine Valley - emission statistics in the framework of the TULLA project.** Friedrich, R.; Mueller, T.; Scheirle, N.; Voss, A.; Bartholomaei, G.; Fluck, F.W. (Stuttgart Univ., Germany, F.R. Inst. fuer Kernenergetik und Energiesysteme; ABAS G.m.b.H., Karlsruhe, Germany, F.R.). Apr 1985. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86751479. (CONF-8503225—).

From 1. status colloquium of the European Research Center project for air pollution abatement measures (PEF) of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (5 Mar 1985).

SO_2 and NOsub(x) emissions in Baden-Wuerttemberg and in the neighbouring parts of the Upper Rhine region will be measured in the TULLA campaign starting in March 1985. Special methods and models will be developed for this purpose. The emissions will be measured every hour in a raster of 1 km x 1 km elements, and source heights will be differentiated. Large-scale emitters will be asked for their own emission data. Trial measurements were made in the pre-campaign period on 2 October 1984. Using the available statistical data and suitable models, energy consumption and emissions will be calculated for the fields of transportation, households, small-scale consumers and small industrial furnaces on a community-by-community basis. The model for calculating energy consumption on the space heating sector is already available while the other models are still in the development stage.

26166 (KFK-PEF—2, pp 385-395) **Experimental contributions for research into meso-scale pollutant transport within the TULLA measurement campaign.** Huebschmann, W.; Thomas, P.; Vogt, S. (Kernforschungszentrum Karlsruhe G.m.b.H., Germany, F.R. Inst. fuer Meteorologie und Klimaforschung). Apr 1985. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86751479. (CONF-8503225—).

From 1. status colloquium of the European Research Center project for air pollution abatement measures (PEF) of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (5 Mar 1985).

The TULLA measurement campaign (Transport und Umwandlung von Luftschadstoffen im Lande Baden-Wuerttemberg und aus Anrainerstaaten, transport and conversion of air-borne pollutants in Baden-Wurttemberg and from adjacent countries), a.o. things, aims at research into meso-scale pollutant transport across orographically structured terrain, studying the existing topography for its possible effect of channelling surface-layer air flow thus forming transport corridors or lanes for gaseous pollutants. Trajectories of air flow are established using tetroons (tared balloons) which are tracked by radar located at an elevated site. Doppler-SODAR is used for measuring the vertical profiles of wind velocity and of wind direction, and a turbulence parameter. In co-operation with GFS-Ispra, these tetroon flights are supplemented to by individual dispersion experiments using SF_6 as tracer. Results provide input and comparative data for numerical simulation models of local to meso-scale pollutant transport. The results of simultaneously performed measurement campaigns are reported.

26167 (KFK-PEF—2, pp 397-411) **Source-specific properties of air particulate materials near the ground. A comparison of laser microprobe mass spectrometry and X-ray fluorescence analysis.** Wieser, P.; Schreiber, H. (Hohenheim Univ., Stuttgart, Germany, F.R. Inst. fuer Physik). Apr 1985. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86751479. (CONF-8503225—).

From 1. status colloquium of the European Research Center project for air pollution abatement measures (PEF) of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (5 Mar 1985).

Air particulate materials in the size range between about 0.1 μm and about 10 μm are collected near the ground at Michaelsberg/Untergrombach, Ebnisee, Edelmannshof, Kaelbelescheuer and during the TULLA pre-experiment at the height of 1500 ft. (aircraft), using five-stage single-jet mini-cascade-impaction devices. The particles are analyzed by means of the laser microprobe massanalyser LAMMA 500 (Leybold-Heraeus). Multivariate statistical methods are used to compare the time-of-flight mass spectra of about 12000 single particles. Simultaneously air filtration devices are exposed near the ground to collect particle samples suitable for X-ray fluorescence analysis (RFA). Time series of element concentrations (e.g. S, K, Fe, Br and Pb) are obtained by the RFA of filter samples, taken at the LfU-stations Mannheim, Karlsruhe and Edelmannshof. Differences in the compositions of the air particulates, collected at the various locations, are detected.

26168 (KFK-PEF—2, pp 425-444) **Regional airborne pollution input analyses for phytotoxic and acid-forming air pollutants.** Halbritter, G.; Braeutigam, K.R.; Kupsch, C.; Sardemann, G. (Kernforschungszentrum Karlsruhe G.m.b.H., Germany, F.R. Abt. fuer Angewandte Systemanalyse). Apr 1985. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86751479. (CONF-8503225—).

From 1. status colloquium of the European Research Center project for air pollution abatement measures (PEF) of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (5 Mar 1985).

Using a model system for calculating long-range, dispersion of air-borne pollutants, the effects of different strategies of fossil fuel application on the air-borne pollutant input situation across a long range (> 100 km), like e.g. substitution of more up-to-date power plants for old ones. Dispersion models were calculated based on regional release-height-dependent distributions of sulphur emissions in Central and Western Europe. Analyses for detecting the causes of the air-borne pollutant input conditions in selected regions of the Federal Republic of Germany reveal that the percentage of the influence of sources abroad may be assumed to be over 70%. In addition, calculations concerning the effects of the large-scale Firing Installation Regulation (GFAVO) which entered into force in 1983, on air-borne pollutant input showed that, though sulphur emissions within the Federal Republic were greatly reduced when this regulation entered into force, it did not have the same effect on air-borne pollutant input proper.

26169 (KFK-PEF—2, pp 445-454) **Emission cadastre for the Upper-Rhine region.** Fluck, F.W.; Bartholomaei, G. (ABAS G.m.b.H., Karlsruhe, Germany, F.R.). Apr 1985. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86751479. (CONF-8503225—).

From 1. status colloquium of the European Research Center project for air pollution abatement measures (PEF) of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (5 Mar 1985).

This project aims at setting up a cadastre for the emission of sulphur dioxide and nitrogen oxides. The cadastre covers all of the Upper-Rhine region including a part of North-West-Switzerland while excluding Alsace as well as emissions by traffic outside of cities in Rhineland-Palatinate. The paper represents the annual emissions of sulphur dioxide and nitrogen oxides of the 1983 reference year for matters of exemplification and makes a detailed study on temporal curves (annual, weekly, daily) of non-industrial sectors and of different industrial branch groups.

26170 (KFK-PEF—2, pp 455-472) **Simulation of pollutant dispersion and photochemical smog formation in urban areas.** Ernst, G.; Moussiopoulos, N.; Zellner, K. (Karlsruhe Univ., T.H., Germany, F.R. Inst. fuer Technische Thermodynamik). Apr 1985. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86751479. (CONF-8503225—).

From 1. status colloquium of the European Research Center project for air pollution abatement measures (PEF) of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (5 Mar 1985).

The aim of this project is the development of the mathematical model DIPHO-nD for the simultaneous simulation of photochemical smog formation and pollutant dispersion. Pollutant concentrations in an urban atmosphere calculated with the photochemical smog model BAPHOS are presented and discussed. A comparison with measurements proves the applicability of the underlying reaction mechanism to conditions of a polluted atmosphere. First results for the spatially one-dimensional case achieved with the model version DIPHO-1D are presented and compared with results of the model BAPHOS. The photochemical smog model will be linked with the mesoscale model currently developed at the Institut fuer Technische Thermodynamik, Universitaet Karlsruhe, for simulations of dispersion phenomena in the planetary boundary layer.

26171 (KFK-PEF—2, pp 493-506) **Development of processes for combinded separation of dusts and gaseous pollutants.** Loeffler, F.; Gaeng, P.; Hedden, K.; Balekdjian, O. (Karlsruhe Univ., T.H., Germany, F.R. Inst. fuer Mechanische Verfahrenstechnik und Mechanik; Deutscher Verein des Gas- und Wasserfaches e.V., DVGW, Karlsruhe, Germany, F.R. Forschungsstelle). Apr 1985. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86751479. (CONF-8503225—).

From 1. status colloquium of the European Research Center project for air pollution abatement measures (PEF) of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (5 Mar 1985).

Research activities aim at developing a technical process for combined separation of dusts and gaseous pollutants from flue gases using filters. The project is to elaborate a solution to waste gas problems of a selected industrial plant with a considerable pollutant emission output (Fa. Lias Leichtbaustoffe GmbH und Co. KG, Tuningen). Participating institutes performed first studies on this plant; future studies were planned for and designed in such a way as to gain fundamental knowledge of filtration and kinetics of the sorption of gas to fine dusts in order to first solve the Lias company emission problems and to subsequently apply findings to similar cases. This report provides information on the expanded-clay plant and, on initial in-situ measurements, and presents a solution tailored to this specific plant requirements and based on these studies, published data and calculations of the authors. In addition, the paper reports on research activities for substantiating the solution concerned; these are planned to be performed both in the laboratories of the participating institutes and in the plant of the Lias company.

26172 (KFK-PEF—2, pp 543-551) **Catalyst composition optimization for selective reduction of nitrogen oxides by ammonia at non-steady-state process management across a broad temperature range.** Kotter, M.; Lintz, H.G. (Karlsruhe Univ., T.H., Germany, F.R. Inst. fuer Chemische Verfahrenstechnik). Apr 1985. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86751479. (CONF-8503225—).

From 1. status colloquium of the European Research Center project for air pollution abatement measures (PEF) of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (5 Mar 1985).

The paper gives an overview on catalysts used in steady-state reaction management, followed by a demonstration of the implications of non-steady-state management. It describes the test appliances manufactured for the experiments and reports first results.

26173 (KFK-PEF—2, pp 563-579) **Optimization of small oil-fired burners: Reduction of NOsub(x) unburned hydrocarbons, and additional pollutants.** Wittig, S.; Kutz, R.; Steinebrunner, K. (Karlsruhe Univ., T.H., Germany, F.R. Inst. fuer Thermische Stroemungsmaschinen). Apr 1985. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86751479. (CONF-8503225—).

From 1. status colloquium of the European Research Center project for air pollution abatement measures (PEF) of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (5 Mar 1985).

The optimization of small oil-fired burners especially with respect to their pollutant emissions is one of the major research-goals at the Institut fuer Thermische Stroemungsmaschinen. The interest derives primarily from ongoing studies of gas turbine combustors. In recognizing the fact that a strong interaction between the main flow field parameters, the fuel atomization, and the combustion exists, detailed measurements were performed under consideration of the various influence parameters. As characteristic times for the mixing, the chemical kinetics and the fuel evaporation should be of importance an attempt is made to develop semi-empirical models for the description of the emissions. Qualitative as well as quantitative aspects are of interest. The early results seem to indicate that the models are of principal validity - at least for the description of the processes as observed in the model combustor. Further studies, however, are necessary.

26174 **(LBL—20591) Heterogeneous SO_2 oxidation and incomplete combustion.** Novakov, T. (Lawrence Berkeley Lab., CA (USA)). Nov 1985. Contract AC03-76SF00098. 10p. (CONF-860425—12). NTIS, PC A02/MF A01; GPO Dep. File Number DE86005980.

From 191. American Chemical Society national meeting; New York, NY, USA (13 Apr 1986).

Most previous work on sulfate aerosols was devoted either to SO_2 conversion during long-range transport or to sulfate formation in urban atmospheres where, because of the high degree of environmental regulations and controls, the pollutant concentrations are relatively low. Much less is known about sulfate chemistry in highly polluted source-dominated urban atmospheres, where scattered, uncontrolled, and usually inefficient small combustion furnaces are major sources of pollutants. Such atmospheres, because of high concentrations of both particles and gases, are more likely to provide conditions for heterogeneous reactions and therefore a greater probability for demonstrating their occurrence and inferring the contributions of local sources to aerosol sulfates. However, source-dominated atmospheres exhibit large spatial and temporal variations in pollutant concentrations. Such atmospheres cannot be represented as well-mixed reactors and are therefore not amenable to conventional modeling techniques. A first step toward eventual understanding of heterogeneous processes in source-dominated regions is an empirical characterization of pollutant behavior. Empirical evidence for heterogeneous SO_2 oxidation in several heavily polluted urban atmospheres is presented. This evidence, complemented by laboratory experiments, points to a link between sulfate production and incomplete combustion, highest when atmospheric conditions favor droplet formation. 9 refs.

26175 **(ORNL—6196) Preliminary assessment of the health and environmental impacts of continuing to store M55 rockets at Lexington-Blue Grass Depot Activity, Anniston Army Depot, Umatilla Depot Activity, Pine Bluff Arsenal, and Tooele Army Depot.** Boyette, J.A.; Breck, J.E.; Coleman, P.R.; Griffin, G.D.; Hillsman, E.L.; Johnson, P.E.; Kornegay, F.C.; Ogles, M.R.; Schweitzer, M.; Sigal, L.L. (Oak Ridge National Lab., TN (USA)). Mar 1986. Contract AC05-84OR21400. 203p. NTIS, PC A10/MF A01; 1; GPO Dep. File Number DE86007944.

The purpose is to provide an assessment of the potential health and environmental impacts of continuing to store M55 rockets filled with nerve agent GB or VX at their current storage locations at Anniston Army Depot in Alabama, Lexington-Blue Grass Depot Activity in Kentucky, Pine Bluff Arsenal in Arkansas, Tooele Army Depot in Utah, and Umatilla Depot Activity in Oregon. The assessment considers the possible impacts of (1) normal storage (with no release to the environment) and (2) two postulated accidents on the air quality, ground and surface water, aquatic ecology, terrestrial ecology, human health, and cultural and socioeconomic resources in and around the various storage depots. The analysis considers three basic scenarios during storage: (1) normal operations; (2) a minor spill of agent (the contents of one rocket released to the biosphere); and (3) a maximum credible event or MCE. The MCE is an igloo fire resulting in the aerosolization of a small (in the case of GB) or an extremely small (in the case of VX) percentage of the igloo's nerve agent contents to the biosphere. The extremely low probabilities of such accidents, which are reported elsewhere, are noted. Our assessments of the impacts of a minor spill and of an MCE consider two sets of meteorological conditions: conservative most likely and worst-case. In addition, we assume that an agent plume would travel toward the area of highest population density. 21 figs., 47 tabs.

26176 **(ORNL—6197) Preliminary assessment of the health and environmental impacts of incinerating M55 rockets stored at Pine Bluff Arsenal, Lexington-Blue Grass Depot Activity, and/or Anniston Army Depot at Pine Bluff Arsenal.** Boyette, J.A.; Breck, J.E.; Coleman, P.R.; Griffin, G.D.; Hillsman, E.L.; Johnson, P.E.; Kornegay, F.C.; Schweitzer, M.; Sigal, L.L.; Thomas, G.A. (Oak Ridge National Lab., TN (USA)). Mar 1986. Contract AC05-84OR21400. 137p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE86007945.

The purpose is to provide an assessment of the potential health and environmental impacts associated with converting and operating an incineration facility currently under construction at Pine Bluff Arsenal (PBA) in Arkansas. The plant is currently designed to dispose of the incapacitating agent BZ, and the converted plant would be designed to incinerate M55 rockets containing the nerve agent GB or VX. For the purposes of this study, the rockets to be incinerated at PBA are those currently stored at PBA and possibly those currently stored at Lexington-Blue Grass Depot Activity in Kentucky and/or at Anniston Army Depot in Alabama. The assessment considers impacts on air quality, ground and surface water, aquatic ecology, terrestrial ecology, human health, and cultural and socioeconomic resources at PBA and its host region. The assessment considers three basic scenarios during plant operations: normal operations, a minor spill of agent (i.e., the nerve-agent contents of one rocket being released to the biosphere), and an onsite transport accident (i.e., vaporization or aerosolization of the contents of two rockets and a spill of the remaining 13 rockets from an M55 rocket pallet) during disposal operations. For our assessment of accident impacts, we considered two separate sets of meteorological conditions: (1) conservative most likely and (2) worst-case.

26177 **(PB—86-117405/XAB) Measurements of polycyclic aromatic hydrocarbons in ambient air particulates in northern New England.** Hornig, J.F.; Barefoot, A.; Parravano, C.; Soderberg, R.H. (Dartmouth Coll., Hanover, NH (USA). Dept. of Chemistry). Oct 1985. 17p. NTIS, PC A02/MF A01.

The paper gives results of measuring polycyclic aromatic hydrocarbons (PAHs) in ambient air particulates in Northern New England. Standard high-volume filter samples of ambient-air partic-

ulates were collected during several heating seasons in a semi-rural village, a rural area, and in residential and institutional neighborhoods in a small town in New Hampshire where wood is an important residential fuel. Extensive development work on extraction and cleanup schemes resulted in a reasonably convenient and reproducible procedure based on extraction of the filters with cyclohexane using ultrasonic agitation, chromatography on silica gel, and extraction of the PAH fraction into dimethylsulfoxide. Concentrations of 13 PAHs were determined by high performance liquid chromatography and by gas chromatography using both flame ionization and mass spectrometric detection. During 2 weeks of intensive sampling in late January 1982, the rural site showed the lowest PAH concentration, with Benz(a)pyrene (BaP) averaging about 1 microgram/cu m, compared to about 3 microgram/cu m in residential Hanover, NH. However, the variations in both the concentrations of individual PAHs among sites and the variations in the relative concentrations of the different PAHs were surprisingly small. Both the total suspended particulates and the PAH concentrations correspond well with the degree-day weather.

26178 **(PB—86-123841/XAB) Carcinogens and mutagens in ambient-air particulate matter: sources and trends in Contra Costa County. Final report.** Flessel, P.; Guirguis, G.; Chang, K.; Cheng, J.; Lecocq, J. (California Dept. of Health, Berkeley (USA). Air and Industrial Hygiene Lab.). Jun 1985. 191p. (CA/DOH/AIHL/SP—35). NTIS, PC A09/MF A01.

The report describes a more-sensitive method for measuring aerosol mutagens, the identification of sources of mutagens and the analysis of trends in mutagen and polycyclic aromatic hydrocarbon (PAH) levels in particulate organic matter (POM). A highly sensitive version of the Ames Salmonella test, called the microsuspension test, was applied to measure the mutagenic activity in organic extracts of community aerosols. Application of the test made possible high resolution diurnal studies of mutagenicity in air samples of only 2 hours duration. The origins of mutagens in POM were investigated during seasonal pollution episodes. Samples were analyzed for mutagenic activity, PAH, NO_3^{-1}, pollutant gases and elemental source tracers. Industrial contributions to mutagenic aerosols were suggested by significant positive correlations between mutagens and S at stations near oil refineries and chemical plants. Mutagens and PAH were also positively correlated with tracers for motor vehicles, (Br, CO) and secondary aerosols NO_3^{-1}. Routine collection and analysis of 4-month seasonal composite filter samples was carried out between 1979-1984. Levels of most pollutants, including mutagens and PAH, were highest in the winter (Nov. - Feb.). Monitoring also revealed a positive trend in the concentration of mutagenic aerosols, despite decreasing or constant levels of other pollutants including PAH.

26179 **(PB—86-126448/XAB) Second review of New Source Performance Standards for Asphalt Concrete Plants.** (Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Air Quality Planning and Standards). Oct 1985. 146p. (EPA/450/3—85/024). NTIS, PC A07/MF A01.

The report reviews the current New Source Performance Standards for Asphalt Concrete Plants. It includes a summary of the current standards, the status of current applicable control technology, and the ability of plants to meet the current standards.

26180 **(PB—86-126935/XAB) Survey of nitrogen oxides, carbon monoxide, and hydrocarbon emissions from industrial and commercial boilers in Scotland.** Walker, D.S.; Galbraith, R.; Galbraith, J.M. (Warren Spring Lab., Stevenage (UK)). 1985. 130p. NTIS, PC A07/MF A01.

Following on from a preliminary field investigation, a survey of nitrogen oxides (NOx), carbon monoxide (CO) and total hydrocarbon (THC) emissions from industrial and commercial gas, oil, and coal-fired boilers was carried out to determine emissions and compile emission factors representative of UK conditions and practices. Measurements were taken from seventy-two boilers. A description, discussion and summary of the information obtained to date is given. Comparisons are made with WSL emission factors and the relevant USEPA factors. The emission factors for boilers burning different fuels are also compared, and an estimate of the total amounts of NOx, CO and THC emitted to the UK atmosphere was calculated for the years 1979 to 1982. A previously reported relationship between boiler heat input and NOx emission rates was confirmed and could be used to predict emission rates from untested plant. A brief account of the investigation and summary of the main results is presented in an executive summary. (Copyright (c) Crown, January 1985).

26181 **(PB—86-129483/XAB) Health Hazard Evaluation Report HETA 84-004-1568, George Washington University Medical Center, Washington, DC.** Gorman, R.; Seligman, P.J. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Mar 1985. 25p. (HETA—84-004-1568). NTIS, PC A02/MF A01.

Area air samples were analyzed for organic solvent vapors and aldehydes at the Biochemistry Department, George Washington University, Washington, DC in October 1983, and February and August 1984. The evaluation was requested by the Safety Director because of employee complaints of eye and respiratory irritation. Questionnaires were administered to 75 employees in the Biochemistry Department and 24 employees in the Pharmacology Department who served as comparisons. Humidity measurements were made. The authors note that the complaints subsided during the spring of 1984, with no explanation. They conclude that the complaints among the employees, especially on the fifth floor, were due to eye irritation. The causative agent could not be identified. Recommendations include evaluating all ventilation systems and repeating the air sampling if complaints of irritation recur.

26182 **(PB—86-129806/XAB) Measuring airborne asbestos following an abatement action.** Keyes, D.L.; Breen, J.J.; Beard, M.E. (Research Triangle Inst., Durham, NC (USA)). Jul 1985. 51p. NTIS, PC A04/MF A01.

One of the most critical points in an asbestos abatement project is knowing when the work has been completed, the contractor can be released, and the building can be reoccupied. This decision should be based on two factors: (1) satisfactory performance of the abatement work, and (2) thorough cleaning of the work site. As outlined herein, these factors should be evaluated by virtually inspecting the work site and by measuring the level of airborne asbestos there. The evaluation should be conducted by the asbestos program manager or the technical advisor assigned to monitor the abatement work. The report discusses various technical issues regarding the air test. Specifications are provided for air sampling and detailed guidelines are presented for using either TEM or PCM to analyze the samples. The information is designed for asbestos program managers and technical program advisors.

26183 **(PB—86-130002/XAB) Detection of hydroxy-nitro-PAHS (-polycyclic aromatic hydrocarbons) in an ambient air particulate extract using bioassay directed fractionation.** Nishioka, M.G.; Howard, C.C.; Lewtas, J. (Battelle Columbus Labs., OH (USA)). Nov 1985. 18p. NTIS, PC A02/MF A01.

Urban air particles contain extractable organic matter with both mutagenic and carcinogenic activity. Detection of the specific compounds responsible for mutagenic activity has been limited by the complexity of these extracts and the presence of highly polar components difficult to identify. To facilitate identifications, these extracts must be separated into substantially less-complex fractions and analyzed with newer analytical techniques. Bioassay-directed fractionation has been proposed as the most cost- and time-effective approach to identifying mutagenic compounds in complex mixtures by directing the analytical and identification research effort toward only significantly mutagenic fractions. This approach should be especially useful for the detection of heretofore unknown constituents of the matrix as the methods are not directed to or developed for specific compounds or compound classes.

26184 **(PB—86-130218/XAB) TRS-80 in-stack opacity computer programs: user and programmer manual. Report for April 1982-June 1983.** Cowen, S.J.; Ensor, D.S.; Sparks, L.E. (Atmospheric Research Group, Inc., Altadena, CA (USA)). Nov 1985. 90p. NTIS, PC A05/MF A01.

The manual describes a microcomputer program written to estimate instack opacity from ducted sources. Input data required to run the program are the particle-size distribution, particle refractive index, mass emission concentration, wavelength of light, particle density, and stack diameter. The particle-size distribution may be entered either as a histogram of particle diameter and fraction-greater-than-stated diameter or as log normal particle size distribution. The program calculates and displays the in-stack opacity. The program is written in the BASIC computer language and is specifically designed for the TRS-80 Model I, II, and IV computers. A moderate effort will be required to convert the programs to the IBM-PC and similar computers.

26185 **(PB—86-130846/XAB) Improvement of a device for detection and characterization of certain atmospheric pollutants. Final report.** Tesseyre, Y. (Centre de Documentation de l'Armement (CEDOCAR), 75 - Paris (France). Direction des Recherches, Etudes et Techniques). 1981. 138p. NTIS, PC A07/MF A01.

The study allowed development of an original measuring system for mobility, involving simultaneously a repulsive electrical field and a continuous gas flow. It made it possible to define a model to calculate ionic transparency of grates, taking into account electrical fields below and above them, ion mobility, speed of gas flow and geometric transparency. Calculation of the electrical field proceeded in a plane-plane system, taking into account the space load and diffusion; a graphic method was developed to determine the field, thus avoiding numerical integration of the diffusion equation. The tracings of the mobility spectra obtained in different gases made it possible to determine characteristic discrete mobility values comparable to those observed by other more sophisticated systems for measuring mobilities, such as the flight time systems. Detection of pollutants in weak concentration in dry air was shown. However, the presence of water vapor in the air forms agglomerates around the ions formed, reducing resolution of the system and making it less applicable under normal atmospheric conditions.

26186 **(PB—86-131950/XAB) Development of a sampler for particulate-associated and low-volatility organic pollutants in residential air.** Howes, J.E.; Merriman, T.L.; Ortiz, C.A.; McFarland, A.R.; Kuhlman, M.R. (Battelle Columbus Labs., OH (USA)). Nov 1985. 47p. NTIS, PC A03/MF A01.

The report describes the development of a sampler for particulate-associated and low volatility organic pollutants in residential air. The performance of the sampler inlet, which is compatible with the proposed PM-10 regulations for particulate sampling, is documented under a variety of conditions of interest. The details of construction of the sampler and the resulting acoustic performance of the unit are described. While the unit described in the report is capable of performing the task for which it has been designed, several design enhancements are recommended that would result in an improved residential air sampler.

26187 **(PB—86-132164/XAB) Health Hazard Evaluation Report HETA-85-108-1593, Carey Plastics Division, Toledo Molding and Die Corp., Carey, Ohio.** Moseley, C.L.; McConnell, R. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). May 1985. 27p. (HETA—85-108-1593). NTIS, PC A03/MF A01.

Environmental and breathing-zone samples were analyzed for organic-solvent vapors, formaldehyde, hydrogen-sulfide, sulfur-dioxide, and carbon monoxide at Carey Plastics, Carey, Ohio in December, 1984. The survey was requested by management and the union local to investigate an outbreak of illness in the workforce. The authors conclude that the illness outbreak was due to a combination of factors, rather than to a single substance. Recommendations include not idling towing motors unnecessarily, installing local exhaust ventilation, and operating the mold at the proper temperature.

26188 **(PB—86-132172/XAB) Health Hazard Evaluation Report HETA-85-020-1587, Department of the Interior, San Francisco Bay National Wildlife Refuge, Newark, California.** Belanger, P.L. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). May 1985. 13p. (HETA—85-020-1587). NTIS, PC A02/MF A01.

Area air samples were analyzed for formaldehyde at the San Francisco Bay National Wildlife Refuge, Newark, California in November and December, 1984. The evaluation was requested by the manager to investigate whether the office staff at the headquarters and visitor center were being exposed to indoor air contaminants due to outgassing from plastic furniture, wood paneling, and the synthetic carpet. Six employees were interviewed to determine if they had experienced any symptoms of formaldehyde exposure. The author concludes that a health hazard does not exist at the facility, but recommends that the formalin solution be well controlled to prevent vapors from spreading to other areas. The formalin solution and other chemicals should be properly stored.

26189 **(PB—86-132180/XAB) Health Hazard Evaluation Report HETA 85-100-1585, Ennox China, Pomona, New Jersey.** Ordin, D.; Seixas, N. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). May 1985. 14p. (HETA—85-100-1585). NTIS, PC A02/MF A01.

A health-hazard evaluation was conducted at Lennox China, Pomona, New Jersey in December, 1984 and January, 1985. The evaluation was requested by an employee representative to investigate a possible excess of cancer in the decal department. Five cases of cancer, all fatal, occurred among the 12 female employees in the department since 1979. The work areas were inspected. Personnel records and death certificates of the employees with cancer were reviewed. Family members of the cancer cases and employer and employee representatives were interviewed. Company industrial hygiene sampling data was reviewed. The authors conclude that there is no identifiable health hazard in the decal department. Development of cancer in the subjects was not due to a common workplace exposure. Recommendations include improving the ventilation system, reevaluating dust exposures, and establishing an educational program on cancer.

26190 **(PB—86-132792/XAB) Health Hazard Evaluation Report HETA 84-307-1581, Big Dry Creek Plant, Westminister, Colorado.** Pryor, P. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Apr 1985. 18p. (HETA—84-307-1581). NTIS, PC A02/MF A01.

Environmental and breathing-zone samples were analyzed for acrylamide, butyl-acetate, acetic-acid, and hydrogen-sulfide at Big Dry Creek waste water treatment facility, Westminister, Colorado in July and November, 1984. Noise monitoring was also conducted. The survey was requested by a facility representative to evaluate potential health hazards associated with chemicals used in the waste-water-treatment process and from noise. The author concludes that a health hazard from chemical over exposure at the facility does not exist. A potential hazard does exist from noise over exposure. Evaluation of all air compressors, periodic noise monitoring, use of hearing protective devices using EPA noise reduction ratings, and an employee education program about chemical and noise exposure hazards are recommended.

26191 **(PB—86-133048/XAB) Health Hazard Evaluation Report HETA 84-392-1597, Syntex Dental Products, Inc., Audubon, Pennsylvania.** Chrostek, W.J. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Jun 1985. 20p. (HETA—84-392-1597). NTIS, PC A02/MF A01.

Environmental and breathing-zone samples were analyzed for carbon dioxide, formaldehyde, mercury, bacteria, and fungi at Syntex Dental Products, Incorporated, Audubon, Pennsylvania in July and August, 1984, and January, 1985. A confidential evaluation was requested because of prolonged employee complaints of eye and respiratory irritation. Ventilation rates and relative humidity of the indoor air were measured. The author concludes that chemical exposures at the facility are not exceeding the OSHA standards. There is a possibility that certain susceptible individuals may be affected by the high relative humidity, lack of outside air, and microorganisms. The author recommends increasing the supply of outside air to the ventilation system, maintaining relative humidity at about 50%, and treating microorganism infested materials with proprietary biocides.

26192 (PB—86-133105/XAB) Industrywide studies report: a walk-through survey of Professional Medical Products, Greenwood, South Carolina. Greife, A.; Steenland, K. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Div. of Surveillance, Hazard Evaluation and Field Studies). 28 Aug 1985. 24p. (IWS—67.46). NTIS, PC A02/MF A01.

A walk-through survey of Professional Medical Products in Greenwood, South Carolina was conducted in June, 1985. The purpose of the survey was to determine the feasibility of including the facility in a NIOSH industrywide mortality/industrial hygiene study of ethylene oxide. The facility used ethylene oxide to sterilize various medical products from 1962 to 1985. Ethylene oxide use was discontinued in February, 1985. The company currently used outside contractors for sterilization. The authors conclude that the facility meets eligibility requirements for the NIOSH study; it can contribute at least 400 person/years; it had adequate personnel records to indicate individual exposures; and a serious confounding exposure to a known leukemogen does not exist. Inclusion of the facility in the NIOSH study is recommended.

26193 (PB—86-133683/XAB) Health Hazard Evaluation Report HETA 83-376-1556, Portsmouth Naval Shipyard, Portsmouth, New Hampshire. Tharr, D.G.; Singal, M. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Apr 1985. 18p. (HETA—83-376-1556). NTIS, PC A02/MF A01.

Area air samples were analyzed for acrolein, aldehydes, organic solvents, acids, and phthalates at Portsmouth Naval Shipyard, Portsmouth, New Hampshire in December, 1983. The evaluation was requested by a union representative due to employee reports of headache, nausea, and other irritative symptoms during systems testing on a submarine being overhauled at the shipyard. The authors conclude that the reported symptoms are due to combined effects of acrolein and other aldehydes. Due to the relatively low concentration involved, the risk of chronic health effects seem slight. Recommendations include properly ventilating the affected work areas and using respiratory personal protective equipment.

26194 (PB—86-133691/XAB) Health Hzzard Evaluation Report HETA 83-044-1596, General Electric Plant, Evendale, Ohio. Parrish, R.G.; Hartle, R.; Groth, D. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Jun 1985. 17p. (HETA—83-044-1596). NTIS, PC A02/MF A01.

Environmental samples were analyzed for asbestos at General Electric, Evendale, Ohio in January and July, 1983. The evaluation was requested confidentially because of concern about electricians who had worked in the heat-treatment-process building and were thought to have suffered adverse effects from exposure to an asbestos-containing insulation material. Eleven current and former employees were interviewed. Only one material sample contained asbestos, 20 to 25% chrysotile. The authors conclude that a health hazard due to asbestos exposure existed in the past, but does not now exist. Recommendations include determining who has been exposed to asbestos, developing an asbestos-screening program, and instituting an educational program for asbestos-exposed employees.

26195 (PB—86-133709/XAB) Health Hazard Evaluation Report HETA 84-046-1584, Hennepin County Medical Center, Minneapolis, Minnesota. Daniels, W.J.; Orris, P. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Apr 1985. 27p. (HETA—84-046-1584). NTIS, PC A03/MF A01.

Personal and area air samples were analyzed for ethylene oxide and waste anesthetic gases at Hennepin County Medical Center, Minneapolis, Minnesota in February, April, and July, 1984. The survey was requested by the center to evaluate health problems among employees. Medical questionnaires were administered and interviews were conducted with 59 employees in the instrument and operating room areas of the ear, nose, and throat, and surgery clinics. Ethylene-oxide was not detected during operation of the sterilizer. Nitrous-oxide concentrations of 66 to 138ppm were detected during surgical procedures. The authors conclude that a health hazard due to exposure to waste anesthetic gases exists at the center. Recommendations include evaluating the ventilation system and conducting additional monitoring for waste anesthetic gases.

26196 (PB—86-133717/XAB) Health Hazard Evaluation Report HETA 84-172-1573, Philadelphia Limerick Power Plant, Pottstown, Pennsylvania. Ruhe, R.L.; Ehrenberg, R. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Apr 1985. 25p. (HETA—84-172-1573). NTIS, PC A02/MF A01.

Environmental and breathing-zone samples were analyzed for formaldehyde and particulates at the Philadelphia Electric Limerick power facility construction site, Pottstown, Pennsylvania in April, 1980. The survey was requested by the union to evaluate exposure to an insulating material containing ammonium-phosphate, fiberglass, and long chain hydrocarbons, because of complaints of respiratory irritation. The authors conclude that a health hazard does not exist at the site. This insulation may be associated with symptoms of mucosal and airway irritation when used in confined spaces. Recommendations include using portable exhaust systems and developing joint management/union education programs dealing with workplace contaminants.

26197 (PB—86-133725/XAB) Health Hazard Evaluation Report HETA 83-107-1574, Dana Corporation, Fort Wayne, Indiana. Parrish, R.G.; Wallingford, K.M. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Apr 1985. 31p. (HETA—83-107-1574). NTIS, PC A03/MF A01.

Environmental and breathing-zone samples of cutting fluids and oils were analyzed at Dana Corporation, Fort Wayne, Indiana in May, 1983. The survey was requested by a company representative to evaluate the cause of dermatitis among machine-tool operators. A cutting fluid used at the facility was thought to be the cause of the dermatitis. Medical questionnaires were administered to 95 workers. Company dispensary records were reviewed. N-nitrosodimethylamine and triethanolamine were detected in new and used cutting fluid samples. Nickel, chromium, and zinc were detected in a sample of used cutting oil residue. Chloromethyl-phenol was found in two cutting fluid mix samples. The authors conclude that a health hazard exists at the facility. The skin problems appear to be related to exposure to cutting fluids and solvents in general, rather than a specific agent. Recommendations include using protective clothing, using waterless hand cleaners instead of solvents, and avoiding contact with chlorothene.

26198 (PB—86-133733/XAB) Health Hazard Evaluation Report HETA 84-228-1582, Schlegel Corporation, Rochester, New York. Boiano, J.M. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Apr 1985. 17p. (HETA—84-228-1582). NTIS, PC A02/MF A01.

Radiofrequency-radiation exposures were evaluated at Schlegal Corporation, Rochester, New York in April and November, 1984. The survey was requested by a union representative to evaluate occupational exposures from radiofrequency heat sealers. The facility used two heat sealers, both of which were unshielded, to manufacture vinyl molding. The company retrofitted the heat sealers with shielding consisting of a box shaped enclosure around the press die constructed out of aluminum. The author concludes that shielding the heat sealers was effective in reducing radiofrequency exposures to below the ACGIH standard. The phosphor bronze contacts should be periodically checked and adjusted if necessary to prevent unnecessary leakage of radiofrequency radiation.

26199 (PB—86-133741/XAB) Health Hazard Evaluation Report HETA 80-007-1520, GSA (General Services Administration) Switchgear Shop, Washington, DC. Moseley, C.L.; Emmett, E. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Oct 1984. 55p. (HETA—80-007-1520). NTIS, PC A04/MF A01.

Environmental and breathing-zone samples were analyzed for polychlorinated biphenyls (PCBs) at the General Services Administration (GSA) switchgear shop, Washington, DC in December, 1979 and January and May, 1980. The survey was requested by GSA to evaluate PCB and other exposures. Environmental samples were also analyzed for tetrachlorodibenzodioxins (TCDDs) and tetrachlorodibenzofurans. Fifty-five current and former employees and 56 comparisons were given complete medical evaluations that included nerve conduction studies and serum and fat PCB analyses.

The authors conclude that a potential health hazard due to PCB exposure exists at the shop. Recommendations include using proper protective clothing and improving work practices.

26200 **(PB—86-133758/XAB) Health Hazard Evaluation Report HETA 81-369-1591, HETA 81-466-1591, Electric Machinery - McGraw Edison Company, Minneapolis, Minnesota.** Stephenson, R.L.; Murphy, D.C.; Habes, D.J. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Apr 1985. 41p. (HETA—81-369-1591). NTIS, PC A03/MF A01.

Environmental and breathing zone samples were analyzed for amines, aliphatic aldehydes, boron-trifluoride-monoethylamine, epichlorohydrin, total volatile fluorides, formaldehyde, lead, methyl- tetrahydrophthalic-anhydride, and n-butyl-glycidyl-ether at Electric Machinery/McGraw Edison Company, Minneapolis, Minnesota in December, 1981 and February, 1983. The surveys were requested by the union local because of irritative symptoms and respiratory problems reported by employees exposed to epoxy resin compounds and impregnated materials. The authors conclude that mucous membrane irritation and dermatitis are common among workers exposed to epoxy resins. A high prevalence of carpal tunnel syndrome was also found. Recommendations include reducing formaldehyde concentrations, using personal protective equipment and barrier creams, and maintaining proper work practices and good personal hygiene to minimize contact with epoxy resin materials.

26201 **(PB—86-133766/XAB) Preliminary survey report: control technology for manual transfer of chemical powders at SCM Glidden Coatings and Resins, Huron, Ohio.** Godbey, F.W.; Heitbrink, W.A. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Aug 1985. 11p. (CT—149-31). NTIS, PC A02/MF A01.

A preliminary survey of control technology for the manual transfer of chemical powders was conducted at SCM Glidden Coatings and Resins, Huron, Ohio in May, 1985. The manufacturing process used local and general-exhaust ventilation to remove or dilute potential air contaminants generated during batching, loading, and mixing operations. The mixing operations were enclosed and highly automated. The ventilation system design appeared to be based on the American Conference of Governmental Industrial Hygienists ventilation manual. Workers were encouraged to use good work practices. They were provided with instruction when hired and received updates and reinforcement as needed. Incentive programs were used to maintain a high degree of motivation. Employees were given preemployment physicals and periodic medical examinations once hired. Periodic atmospheric dust monitoring was performed. The only personal protective equipment required was safety glasses with side shields. Respirators were not required as airborne dust concentrations were low, only 20% of the threshold limit value as shown by company data. The authors conclude that the facility is a well-designed and operated manufacturing operation. An in-depth survey of control technology at the facility is recommended.

26202 **(PB—86-133774/XAB) Health Hazard Evaluation Report HETA 84-321-1590, asbestos shingle tear-off, Rockford, Illinois.** Reed, L.D. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). May 1985. 13p. (HETA—84-321-1590). NTIS, PC A02/MF A01.

Breathing-zone samples were analyzed for asbestos during removal of an old asbestos shingle roof from a residential building, Rockford, Illinois in May, 1984. The evaluation was requested to assess asbestos exposures during removal operations. A bulk sample of the asbestos shingle was analyzed and found to contain 30% chrysotile. NIOSH certified half/face respirators with high efficiency particulate filters were worn by all members of the tear off and cleanup crews. The author concludes that since the NIOSH criteria for asbestos exposure is the lowest feasible concentration, a hazard from airborne asbestos fibers existed during the roof removal operation. Recommendations include wetting the roof before beginning removal, evacuating the building occupants if feasible, sealing off all doors, windows, and other openings, removing all work clothes before leaving the site, and laundering them seperately.

26203 **(PB—86-133782/XAB) Health Hazard Evaluation Report HETA 84-395-1588, Encinitas Floral Company, Encinitas, California.** Coye, M.J.; Belanger, P.L. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). May 1985. 23p. (HETA—84-395-1588). NTIS, PC A02/MF A01.

A health-hazard evaluation of Encinitas Floral Company, Encinitas, California was conducted in June and July, 1984. The confidential evaluation was requested because of concern about possible exposures to Temik and other pesticides used at the company's two sites, Sanford and Saxony. Medical interviews were conducted with an unspecified number of employees. Work practices were observed. The authors conclude that a health hazard exists at both sites. Recommendations include establishing a formal respirator program in accordance with OSHA requirements, wearing personal protective clothing and equipment, and improving the exhaust ventilation systems.

26204 **(PB—86-134020/XAB) Hydrogen chloride and hydrogen fluoride emission factors for the NAPAP (National Acid Precipitation Assessment Program) emission inventory. Final report, July 1983-1985.** Misenheimer, D.C.; Battye, R.E.; Clowers, M.R.; Werner, A.S. (GCA Corp., Chapel Hill, NC (USA). GCA Technology Div.). Oct 1985. 86p. (GCA-TR-CH—84-04). NTIS, PC A05/MF A01.

The report gives results of a study to develop emission factors for significant sources of hydrogen chloride and hydrogen fluoride. Information developed in the report includes significant emission sources, source descriptions, uncontrolled emission factors, controls commonly used, and average control efficiencies. An assessment of the accuracy of each efficiency factor is also included.

26205 **(PB—86-135431/XAB) Health Hazard Evaluation Report HETA 85-132-1598, Mystic Seaport, Mystic, Connecticut.** Landrigan, P.J.; Straub, W.E. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). May 1985. 21p. (HETA—85-132-1598). NTIS, PC A02/MF A01.

Environmental and breathing-zone samples were analyzed for lead at Mystic Seaport, Mystic, Connecticut in January and February, 1985. The evaluation was requested by the facility to assess lead exposures during cutting and rivetting operations aboard a lead painted, iron hulled ship. Blood lead and erythrocyte protoporphyrin (EP) concentrations were determined in 10 shipfitters. Noise exposure measurements were made. The authors conclude that shipfitters working aboard ship are overexposed to lead and noise. Recommendations include substituting lead based paint with less toxic materials if feasible, avoiding the use of lead/based putty, and establishing a hearing conservation program.

26206 **(PB—86-135449/XAB) Health Hazard Evaluation Report HETA 84-041-1592, Johnson Controls, Inc., Owosso, Michigan.** Singal, M.; Zey, J.N.; Arnold, S.J. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). May 1985. 48p. (HETA—84-041-1592). NTIS, PC A03/MF A01.

Environmental and breathing-zone samples were analyzed for inorganic arsenic, stibine, antimony, and sulfuric-acid at Johnson Controls, Incorporated, Owosso, Michigan in November, 1983 and April, 1984. The evaluation was requested by the union to assess exposures to lead and other substances. Concern was expressed about apparent physiological discrepancies between blood lead and zinc-protoporphyrin (ZPP) concentrations in certain workers. Company lead monitoring and blood lead/ZPP data was reviewed. Urine samples were obtained from 49 workers and analyzed for arsenic. The authors conclude that there is no definite pattern in the company blood lead/ZPP data. Maintenance and janitorial personnel have the greatest potential for lead exposure. Recommendations include keeping worker blood ZPP concentrations from rising excessively and improving the respirator program.

26207 **(PB—86-135613/XAB) Industrywide studies report: a walk-through survey of Becton, Dickinson and Company, Incorporated, Canaan, Connecticut.** Greife, A.; Stayner, L. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Div. of Surveillance, Hazard Evaluation and Field Studies). 24 Sep 1985. 24p. (IWS—67.31). NTIS, PC A02/MF A01.

A walk-through survey was conducted at Becton, Dickinson and Company, Incorporated, Canaan, Connecticut in September, 1984. The purpose of the survey was to determine the feasibility of including the facility in a NIOSH industry wide mortality/industrial hygiene study of ethylene oxide. All employees were instructed in proper practices for working with ethylene oxide. The manufacturing, molding, office and laboratory areas had separate recirculating, heating, ventilation, and air conditioning systems. The sterilization area which had its own ventilation system was maintained under negative pressure, relative to the rest of the building. The authors conclude that the facility is eligible for inclusion in the NIOSH study. Recommendations include conducting industrial hygiene sampling in areas where data does not exist and evaluating ventilation in the link area.

26208 **(PB—86-135621/XAB) Industrywide studies report: a walk through survey of Ross Laboratories (Division of Abbott Laboratories), Columbus, Ohio.** Greife, A.; Steenland, K. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Div. of Surveillance, Hazard Evaluation and Field Studies). 2 Oct 1985. 15p. (IWS—67.35). NTIS, PC A02/MF A01.

A walk-through survey was conducted at Ross Laboratories, a Division of Abbott Laboratories, Columbus, Ohio in August, 1985. The purpose of the survey was to determine the feasibility of including the facility in a NIOSH industry wide mortality/industrial hygiene survey of ethylene oxide. The facility produced infant formula and infant related products, including nipples. The company had a full time nurse on the first and second shifts. A physician was available on a contract basis. New employees were given preemployment physicals. Employees received annual physicals until 1982 after which they became optional. The physicals did not include any components relating to ethylene-oxide exposure. The authors conclude that the personnel records are not adequate to identify a cohort of exposed individuals at the facility. The facility will not be included in the NIOSH study.

26209 **(PB—86-135639/XAB) Variability in patterns of acid deposition resulting from climatological variability.** Shannon, J.D.; Lesht, B.M.; Samson, P.J. (Argonne National Lab., IL (USA)). Dec 1985. 8p. NTIS, PC A02/MF A01.

Seasonal variability of sulfur wet-deposition predictions were assessed for a six-year period (1976-1981). From a 1980 SO_2 emissions data base and a 1976-1981 meteorological data base, the Advanced Statistical Trajectory Regional Air Pollution (ASTRAP) model produced 30 seasonal and annual sulfur wet-deposition patterns and source-receptor matrices for North America. In addition, patterns of the coefficients of variation were also produced. The annual wet-deposition patterns were very similar with the maximum amounts predicted across eastern Ohio, western Pennsylvania and northern West Virginia. Variability of the seasonal patterns was more pronounced, especially for winter. The coefficients of variation were the smallest where the maximum depositions were predicted and greater in remote regions.

26210 **(PB—86-136504/XAB) Survey of chloroform emission sources. Final report.** Dulestsky, S.; Rehm, R.; Smith, M. (Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Air Quality Planning and Standards). Oct 1985. 225p. (EPA/450/3—85/026). NTIS, PC A10/MF A01.

The potential public health impact of chloroform exposure is being investigated. The document contains information on the sources of chloroform emissions, current emission levels, control methods that could be used to reduce chloroform emissions, and cost estimates for employing controls.

26211 **(PB—86-136546/XAB) CDM 2.0 (Climatological Dispersion Model - Version 2.0) user's guide. Final report.** Irwin, J.S.; Chico, T.; Catalano, J. (Aerocomp, Inc., Costa Mesa, CA (USA)). Nov 1985. 151p. NTIS, PC A08/MF A01.

CDM-2.0 (Climatological Dispersion Model - Version 2.0) determines long-term (seasonal or annual) quasi-stable pollutant concentrations in rural or urban settings, using average emission rates from point and area sources and a joint frequency distribution of wind direction, wind speed, and stability. The Gaussian plume hypothesis forms the basis for the calculations. Contributions are calculated assuming the narrow plume hypothesis, Calder (1971, 1977), and involve an upwind integration over the area sources. Computations can be made for up to 200 point sources and 2500 area sources at an unlimited number of receptor locations. The number of point and area sources can be easily modified within the code. CDM-2.0 is an enhanced version of CDM, including the following options: 16 or 36 wind-direction sectors, initial plume dispersion, buoyancy-induced dispersion, stack-tip downwash, and gradual (transitional) plume rise. The user has a choice of seven dispersion parameter schemes. Optional output includes point and area concentration roses and histograms of pollutant concentration by stability class.

26212 **(PB—86-136645/XAB) Health Hazard Evaluation Report HETA 84-239-1586, Ashland Super Valu, Ashland, Wisconsin.** Daniels, W.J.; Donohue, M.T.; Singal, M. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). May 1985. 18p. (HETA—84-239-1586). NTIS, PC A02/MF A01.

Environmental and brathing zone samples were analyzed for di(2-ethylhexyl)adipate, hydrogen-chloride, cyclohexanol, dicyclohexyl-phthalate, phthalic-anhydride, and total particulates at Ashland Super Valu, Ashland, Wisconsin in June, 1984. The evaluation was requested by a company representative due to complaints of respiratory problems by one of the meat department employees. Four meat department employees were interviewed. The authors conclude that it is not possible to determine whether or not the symptoms reported by the meat packer are due to emissions from heated meat wrap or label adhesive. Recommendations included not operating the cool rod cutter at a temperature above 280 degrees-F and installing local exhaust ventilation.

26213 **(PB—86-136652/XAB) Industrial hygiene report, preliminary survey of wood preservative treatment facility at Koppers Company, Inc., Forest Products Group, Florence, South Carolina.** Todd, A.S.; Timbie, C.Y. (Stewart-Todd Associates, Inc., Wayne, PA (USA)). 16 Nov 1979. 17p. NTIS, PC A02/MF A01.

A walk through survey was conducted at Koppers Company, Incorporated, Florence, South Carolina in July, 1984. The facility treated poles, posts, and railroad ties with creosote, pentachlorophenol, or chromated copper arsenate. Pentachlorophenol monitoring was performed and showed pentachlorophenol exposures of 0.04 to 0.12 mg/cm^3. Sampling was attempted for creosote, but the data were invalid due to faulty analytical techniques. The facility employed 141 people, of whom 125 were production workers and 16 were administrative staff. All employees were required to wear hard hats and safety shoes. Treatment operators and helpers were supplied with eye protection, gloves, boots, disposable coveralls, and slickers when needed. Respirators were provided when entering treatment cylinders. Preemployment medical examinations were conducted on all new employees. Periodical physicals were not offered. No physician or licensed nurse was located on site. Two employees trained in first aid were responsible for providing emergency treatment. About half of the employees used work uniforms while the remainder brought work clothing from home. Showers and change room facilities were provided.

26214 **(PB—86-136710/XAB) Health Hazard Evaluation Report HETA 84-050-1595, PPG Industries, Mt. Zion, Illinois.** Almaguer, D. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). May 1985. 14p. (HETA—84-050-1595). NTIS, PC A02/MF A01.

Environmental and breathing zone samples were analyzed for adipic-acid and total and respirable dust at PPG Industries, Mount Zion, Illinois, January and September, 1984. The evaluation was requested to investigate employee exposure to Lucor and wood flour, used during the oil/bearing of flat glass. The author concludes that a health hazard due to exposure to Lucor does not exist at the facility. It could not be determined if a health hazard from exposure to wood dusts existed in the past, since the use of wood flour had been discontinued. Recommendations include using a heavy duty industrial vacuum cleaner during cleanup operations and practicing good housekeeping.

26215 **(PB—86-137163/XAB) Epidemiology and air pollution. Final report.** (National Research Council, Washington, DC (USA). Committee on the Epidemiology of Air Pollution). Oct 1985. 231p. NTIS, PC A11/MF A01.

The report explores the scientific feasibility of conducting epidemiologic investigations of the health consequences of current and future air pollution. It assesses the limits of available epidemiologic techniques for studying air-pollution problems and discusses opportunities for expanding these limits and for using epidemiologic studies effectively in an overall program of research on air pollution.

26216 **(PB—86-137445/XAB) Industrial hygiene report: preliminary survey of wood-preservative treatment facility at Permapost Products Company, Hillsboro, Oregon.** Todd, A.S.; Timbie, C.Y. (Stewart-Todd Associates, Inc., Wayne, PA (USA)). Aug 1979. 22p. NTIS, PC A02/MF A01.

A walk-through survey was conducted at Permapost Products Company, Hillsboro, Oregon in June, 1979. Area air monitoring for pentachlorophenol was conducted using a NIOSH method and a silica-gel tube technique. The facility treated prefabricated bridge structures, playground equipment, picnic tables, and other specialty items with pentachlorophenol or chromated copper arsenate. The facility had no formal medical-monitoring program. Audiometric testing was performed annually on a contract basis. The company utilized the local hospital emergency room, located 5 minutes away. Work practices, processing methods, and protective equipment such as cartridge half-face respirators, elbow length gloves, and impervious aprons were used to control exposures to the wood preservatives. The authors note that since they took only a small number of samples, a meaningful comparison of the two analytical methods cannot be made.

26217 **(PB—86-137452/XAB) Elemental mercury exposure and uptake among children of thermometer plant workers.** Hudson, P.J.; Vogt, R.L.; Brondum, J.; Witherell, L.; Myers, G. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Sep 1985. 17p. NTIS, PC A02/MF A01.

A survey of mercury exposure and uptake in children of workers exposed to mercury was conducted. The impetus for the study was a previous survey that identified significant urinary mercury concentrations among employees of a mercury thermometer and glass-manufacturing facility in Vermont. The cohort consisted of 23 children of the exposed workers. The comparisons consisted of 39 children randomly selected from parents not employed at the facility. The median age of both groups was 10 years. Urine samples were collected and analyzed for mercury. All subjects were examined by a pediatric neurologist having clinical experience with mercury toxicity. Questionnaires were administered to parents to identify symptoms of mercury toxicity. The median urine mercury concentrations in the cohort and comparisons were 25 and 5 micrograms per liter, respectively. Urine mercury concentrations of the exposed children were significantly correlated with those of their parents. No signs of overt mercury toxicity were seen. No evidence of subtle neurotoxicity in the exposed subjects was found. The authors conclude that heavily exposed parents are more likely to carry mercury home than less-exposed parents, resulting in a risk to their children.

26218 **(PB—86-137890/XAB) Health Hazard Evaluation Report HETA 84-026-1599, US Penitentiary, Terre Haute, Indiana.** Crandall, M.S. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). May 1985. 17p. (HETA—84-026-1599). NTIS, PC A02/MF A01.

Breathing zone and environmental samples were analyzed for formaldehyde at the United States Penitentiary, Terre Haute, Indiana in January, 1984. The evaluation was requested by the safety manager to assess formaldehyde exposures among inmates manufacturing bed sheets. The fabric used to make the sheets had been treated with a formaldehyde containing resin to make it wrinkle resistant. A questionaire survey of 25 inmates was conducted to characterize health complaints. The author concludes that the formaldehyde exposures, while less than the OSHA limit, are higher than those recommended by NIOSH. NIOSH considers formaldehyde a potential occupational carcinogen and recommends that exposures be maintained at the lowest feasible limit. The inmates experienced irritating symptoms consistent with those from exposure to formaldehyde. The author recommends airing of fabrics prior to use and installing a dilution ventilation system.

26219 **(PB—86-137908/XAB) Health Hazard Evaluation Report HETA 84-384-1580, Crystal Zoo, Boulder, Colorado.** Gunter, B.; Thoburn, T.W. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Apr 1985. 18p. (HETA—84-384-1580). NTIS, PC A02/MF A01.

Environmental and breathing zone samples werr analyzed for 1,1,1-trichloroethane, toluene, petroleum distillate, lead, quartz, cristobalite, and total particulates at Crystal Zoo, Boulder, Colorado in August, 1984. The evaluation was requested by the management because of concern for the workers health. Medical questionnaires were administered to eight workers in the leaded-crystal grinding room. Blood lead and free erythrocyte protoporphyrin (FEP) concentrations were measured in the grinding-room workers and in three comparisons. The authors conclude that a health hazard due to overexposure to lead exists in the grinding department. Recommendations include improving work practices, prohibiting dry grinding of polishing of leaded glass, and installing downdraft ventilation.

26220 **(PB—86-138278/XAB) Health Hazard Evaluation Report HETA-80-073-1589, Marion Power Shovel, Marion, Ohio.** Stephenson, R.L.; Liss, G.M. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Apr 1985. 56p. (HETA—80-073-1589). NTIS, PC A04/MF A01.

Environmental and breathing-zone samples were analyzed for methylene-bisphenyl-isocyanate (MDI), total reactive isocyanate groups (TRIG), triethylamine, mineral spirits, and metal fume at Marion Power Shovel Foundry, Marion, Ohio, in March and September, 1983. The evaluation was requested by the union to assess exposures in the core and mold areas where MDI binders were used. Interviews were conducted with 26 exposed and 13 nonexposed workers. Medical examinations that included pulmonary function and immunological testing, and chest x-rays were administered. All exposures were below the OSHA standards for TRIG. Previously obtained silica monitoring data was reviewed. Silica overexposure was indicated. Twenty-seven exposed workers reported lower respiratory tract symptoms consistent with occupational asthma. The authors conclude that significant exposures to isocyanates have occurred at the facility. A health hazard due to silica also exists. Recommendations include establishing a medical surveillance program for MDI and reducing silica exposures by appropriate engineering controls.

26221 **(PB—86-138286/XAB) Industrial-hygiene survey report of Dravo Corporation, Engineering Works Division, Neville Island, Pittsburgh, Pennsylvania.** Bloom, T.F.; Dooley, D.; Peguese, J.E. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Jul 1985. 82p. (IWS—74.46). NTIS, PC A05/MF A01.

An industrial-hygiene survey was conducted at Dravo Corporation, Engineering Works Division, Neville Island, Pittsburgh, Pennsylvania in July, 1981. The purpose of the survey was to evaluate occupational exposure associated with painting and coating processes during the construction of barges and towboats. Sampling for organic and paint solvents, metals, and nuisance dust was performed. At least one lead and dust sample exceeded their OSHA standards, 0.05 and 15 milligrams per cubic meter, respectively. The equivalent threshold limit value of 1 based on NIOSH criteria was exceeded by a mixture of toluene, xylene, naphtha, and mineral

spirits in the inner hull area. Mixtures were considered to be toxicologically additive. All painters wore coveralls, head clothes, hard hats, gloves, and respirators. Dilution ventilation was useful in confined spaces. Air flowrates appeared to be inadequate for sufficiently diluting solvent vapors. The authors conclude that lead and nuisance dust concentrations exceed the OSHA standards at the facility. Exposure to solvent mixtures whose effects are assumed to be additive are a cause for concern. Recommendations include reducing naphtha, mineral spirits, and lead concentrations in the inner hull area, and thoroughly drying solvent coated workpieces before stacking them.

26222 (PB—86-138724/XAB) Health Hazard Evaluation Report HETA 84-151-1544, Nuturn Corporation, New Castle, Indiana. Ruhe, R.L.; Lipscomb, J. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Apr 1985. 22p. (HETA—84-151-1544). NTIS, PC A02/MF A01.

Environmental and breathing zone samples were analyzed for asbestos, formaldehyde, phenol, and total particulates at Nuturn Corporation, New Castle, Indiana in June, 1984. The survey was requested by a union representative to evaluate asbestos exposure during the manufacture of brake shoe linings. The authors conclude that a health hazard due to asbestos exposure exists at the facility. Recommendations include reducing asbestos exposures by engineering controls, good work practices, administrative controls, and using personal protective equipment. Asbestos should be replaced if feasible.

26223 (PB—86-139219/XAB) Health Hazard Evaluation Report HETA 84-394-1577, Robert Hall Co., Inc., Encinitas, California. Coye, M.J.; Belanger, P.L. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Apr 1985. 23p. (HETA—84-394-1577). NTIS, PC A02/MF A01.

A health evaluation was conducted at Robert Hall Company, Incorporated, Encinitas, California, in June/July, 1984. The evaluation was requested by an employee representative because of concern about potential exposures to Temik and 16 other pesticides used at the facility. A walk-through survey of all growing, storage, pesticide mixing and loading areas was conducted. Work practices were observed. Some workers were given medical interviews. The authors conclude that a health hazard exists at the facility. Recommendations include instituting a formal respirator program in accordance with OSHA requirements, posting copies of spray schedules, posting of signs after spraying in English and Spanish, and offering periodic, brief educational programs on health and safety.

26224 (PB—86-139375/XAB) Bibliography on indoor air pollution. (Environmental Protection Agency, Washington, DC (USA). Information Management and Services Div.). Jun 1985. 91p. (EPA/IMSD—85/002). NTIS, PC A05/MF A01.

This bibliography on Indoor Air Pollution highlights Sources of Indoor Air Pollution, Factors Contributing to Indoor Air Pollution, the Health Effects of Indoor Air Pollution, and Measures to Mitigate Indoor Air Pollution.

26225 (PB—86-139599/XAB) Progress in the prevention and control of air pollution in 1984. (Environmental Protection Agency, Research Triangle Park, NC (USA). Control Programs Development Div.). Nov 1985. 81p. (EPA/450/2—85/007). NTIS, PC A05/MF A01.

The report first describes the progress made by the Environmental Protection Agency (EPA) in prevention and control of air pollution during 1984. Also discussed are current understanding of air quality problems, controls, and administrative apparatus. Since it takes approximately a year to assemble, analyze, and report air quality and emissions data on a national basis, the latest air quality and emissions data available for the report are for the year 1983.

26226 (PB—86-140514/XAB) Validation of models for predicting formaldehyde concentrations in residences due to pressed wood products. Phase 1. Grot, R.A.; Silberstein, S.; Ishiguro, K. (National Bureau of Standards, Washington, DC (USA). Building Physics Div.). Sep 1985. 148p. (NBSIR—85/3255). NTIS, PC A07/MF A01.

The interim report describes procedures and presents results of the first phase of a laboratory project undertaken at the National Bureau of Standards for the Consumer Product Safety Commission (CPSC). The purpose of the project is to assess the accuracy of emission and indoor-air-quality models to be used by CPSC in predicting formaldehyde (HCHO) concentrations in residences due to pressed-wood products made with urea-formaldehyde bonding resins, namely particleboard underlayment, hardwood-plywood paneling and medium-density fiberboard (MDF). In phase I, these products were characterized in medium-size dynamic measuring chambers by measuring their HCHO surface emission rates over a range of HCHO concentrations, at 23C and 50% RH. They were then installed in a two-room prototype house and the equilibrium HCHO concentrations were monitored as a function of air exchange rate. Excellent agreement was obtained between measured HCHO concentrations and those predicted by a mass-balance indoor air quality model. In the next phase, the study will be repeated at various different temperatures and relative humidities so that models predicting HCHO surface emission rate as a function of temperature and humidity can be tested.

26227 (PB—86-141231/XAB) Health Hazard Evaluation Report HETA 82-289-1496, Schlegel Corporation, Rochester, New York. Reed, L.D.; Lipscomb, J. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Aug 1984. 20p. (HETA—82-289-1496). NTIS, PC A02/MF A01.

Environmental and breathing zone samples were analyzed for stainless steel fibers and carbon particulates at Schlegal Corporation, Rochester, New York in October, 1982 and November, 1983. The survey was requested by a union representative to evaluate dermatitis and possible respiratory effects resulting from exposures during production of electrostatic brushes. Medical interviews were conducted with 22 employees in 1982 and 20 employees during the 1983 survey. There are no federal standards for steel or carbon fibers. Eye, skin, and throat irritation and skin rash were the most frequently reported symptoms; the incidence of the symptoms increased in 1983. The authors conclude that inhaling carbon or stainless steel fibers probably does not pose a health risk. Recommendations include using personal protective equipment and properly maintaining the ventilation systems to reduce the incidence of eye and skin irritation.

26228 (PB—86-141249/XAB) Health Hazard Evaluation Report HETA 84-513-1572, Hawaii News Agency, Honolulu, Hawaii. Okawa, M.T. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Apr 1985. 15p. (HETA—84-513-1572). NTIS, PC A02/MF A01.

On September 5, 1984, the National Institute for Occupational Safety and Health (NIOSH) received a request from an authorized representative of employees from the Hawaii Newspaper Agency (HNA), Honolulu, Hawaii, to conduct a health-hazard evaluation of the indoor air quality in the HNA Building. The requestor was concerned about the incidence of colds, flu, and sore throats which seemed to linger among employees in the Star-Bulletin side of the Building. On October 17, 1984, the NIOSH investigator visited the Building in order to obtain information on the ventilation system, to pass out a short questionnaire concerning possible workplace related symptoms, and to take detector tube readings for carbon dioxide (CO_2). On October 18, 1984, the NIOSH investigator repeated CO_2 samples and also took detector tube readings for carbon monoxide (CO). The detector tube measurements for CO_2 and CO were used as a screening device to assess the general air circulation in the office spaces.

26229 (PB—86-141256/XAB) Health Hazard Evaluation Report HETA 85-065-1578, United Hospital, Grand Forks, North Dakota. Gunter, B.J. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Apr 1985. 10p. (HETA—85-065-1578). NTIS, PC A02/MF A01.

Environmental and breathing zone samples were analyzed for ethylene-oxide at United Hospital, Grand Forks, North Dakota in January, 1985. The survey was requested by the management to determine if using ethylene-oxide for sterilization purposes posed a health risk. All employees (number not specified) in the central supply department were interviewed. These concentrations origi-

nated from an old sterilizer. The sterilizer was not normally used, but was operated on the day of the survey to stimulate a worst-case situation. None of the workers had any medical complaints. The author concludes that a health hazard due to ethylene-oxide does not exist at the facility. He recommends not using the old sterilizer until it has been refurbished and conducting periodic monitoring for ethylene/oxide with an infrared analyzer.

26230 **(PB—86-141876/XAB) Health Hazard Evaluation Report HETA 84-404-1579, Florida State Archives, Tallahassee, Florida.** Crandall, M.S.; Hartle, R.W.; Elliott, L.J. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Apr 1985. 28p. (HETA—84-404-1579). NTIS, PC A03/MF A01.

Environmental and breathing zone samples were analyzed for ethylene/oxide at the Florida State Archives, Tallahassee, Florida in November, 1984. The evaluation was requested to determine if an ethylene-oxide fumigator could be operated safely in view of the change in the OSHA standard from 50 to 1 part per million (ppm). Ventilation measurements were made. The ventilation system dedicated to the fumigation operation worked well. The fumigation area was under sufficient negative pressure to prevent contamination of other parts of the building. The authors conclude that a health hazard exists if the fumigation system is operated without additional controls. Recommendations include adding local exhaust ventilation and using respiratory protection devices.

26231 **(PB—86-141942/XAB) Exploration of combustion limitations and alternatives to the NBS (Bational Bureau of Standards) toxicity test method.** Levin, B.C.; Babrauskas, V.; Braun, E.; Gurman, J.; Paabo, M. (National Bureau of Standards, Washington, DC (USA). Center for Fire Research). Nov 1985. 87p. (NBSIR—85/3274). NTIS, PC A05/MF A01.

Some limitations and potential limitations of the NBS toxicity screening test method had been identified in earlier work. These limitations have now been explored in greater detail. Also investigated was an alternative combustion system, consisting of a radiant cone heater, identical to the one in the recently developed Cone Calorimeter, an enclosed combustion chamber, and a slightly revised variant of the animal chamber. The new animal chamber was so constructed that, prior to the insertion of the animals, it could be evacuated and then back-filled with a desired sampling of the combustion products. The radiant combustion system showed a different mix of capabilities and limitations compared to the cup furnace combustor in the existing test method. In the present project, the more detailed assessment of the cup furnace operation leads to the recommendation that there is no single, universally preferable combustion environment, but that the cup furnace is adequate for the intended purpose of providing toxicity screening.

26232 **(PB—86-142155/XAB) Size-specific total particulate emission factors for mobile sources. Final report.** (Energy and Environmental Analysis, Inc., Arlington, VA (USA)). Aug 1985. 82p. NTIS, PC A05/MF A01.

The report presents particulate emission-factor equations as the sum of individual masses of lead salt, organic, and sulfate components for leaded- and unleaded-gasoline-fueled vehicles. Composite (i.e., total particulate mass) equations are presented for diesel fueled vehicles and motorcycles, and tire and brake-wear particulates. These equations are subsequently accompanied by tabulated emission factors that may be inserted into the appropriate particulate component equations. Fleet sales fractions and travel fractions by model year are included for each vehicle class. The fractions within each vehicle class equipped with different emission-control systems also are provided. Cumulative distributions of particle size for leaded and unleaded gasoline and diesel fuel are presented both graphically and tabularly. Also, for the benefit of the user, an example calculation of particulate emissions from light-duty vehicles is provided. The procedure herein can be used to project automotive particulate emissions by those agencies developing State Implementation Plans for particulate matter or by other interested parties within or outside the EPA concerned with size specific particulate emission-factor projections for mobile sources.

26233 **(PB—86-142163/XAB) Mine particulate size characterization. Open file report, 1 October 1979-31 December 1981.** Welker, R.W.; Eisenberg, W.; Semmler, R.A.; Yucuis, G.J. (IIT Research Inst., Chicago, IL (USA)). Jan 1982. 209p. (IITRI-C—06472). NTIS, PC A10/MF A01.

A technique was developed for sampling and analyzing airborne dusts in diesel-operated underground metal and nonmetal mines. Samples were taken using personal respirable samplers, operated as area samplers, and an 11-stage cascade impactor. Real-time particle size distribution and concentration measurements were made with a quartz crystal microbalance cascade impactor and a portable electrical aerosol analyzer. The materials characterized were minerals (by x-ray diffraction), elements (by x-ray fluorescence), particle-size distribution and concentration (gravimetrically), and organic constituents (by high-performance liquid chromatography). The method was used to characterize dusts generated at the chute pulling operations on the main haulage level of an underground tungsten mine. It was concluded that size selective sampling may be used to estimate the ratio of diesel exhaust to nondiesel dusts in the respirable fraction.

26234 **(PB—86-142346/XAB) Guidelines on preferred location and design of measurement ports for air-pollution-control systems.** Richards, J.R. (JACA Corp., Fort Washington, PA (USA)). Sep 1984. 52p. NTIS, PC A04/MF A01.

Portable instrumentation is used in evaluating the performance of air-pollution-control systems by both regulatory-agency compliance inspectors and source operators. However, the use of instrumentation, such as static pressure gauges, thermocouples, oxygen analyzers, and pitot tubes, has been limited by the lack of adequate measurement ports on the existing control systems. This report examines the parameter data requirements and provides recommendations on measurement port design and location.

26235 **(PB—86-144623/XAB) Modeling transport by convective clouds for regional air-pollution models.** Vukovich, F.M. (Research Triangle Inst., Durham, NC (USA)). Dec 1985. 8p. NTIS, PC A02/MF A01.

A model is developed to account for regional-scale vertical transport of pollutants from the mixed layer to the overlying free troposphere by an ensemble of nonprecipitating cumulus convective clouds. The model determines acceptable cloud classes for given atmospheric state represented by the moist static energy distribution. The cloud classes are defined by dry entrainment rate, cloud depth, and convective cloud amounts. The clouds are of course driven by regional-scale heat and moisture convergence. Empirical data was collected and used to formulate a closure scheme to obtain the necessary cloud parameters. A statistical that predicts the vertical distribution of cloud amount from cloud base was developed. The vertical variation of cloud amounts depends on the distribution of clouds having different depths.

26236 **(PB—86-144656/XAB) Stability of parts-per-billion hazardous organic cylinder gases and performance audit results of source test and ambient-air measurement systems. Status report 2.** Jayanty, R.K.M.; Cooper, S.W.; Sokash, J.A.; Decker, C.E. (Research Triangle Inst., Durham, NC (USA)). Dec 1985. 146p. NTIS, PC A07/MF A01.

A repository of 22 gaseous organic compounds at parts-per-billion (ppb) levels in compressed gas cylinders has been established by the U.S. Environmental Protection Agency (EPA). The primary objectives of this ongoing project are: (1) to provide accurate gas mixtures to EPA, state/local agencies, or their contractors for performance audits to assess the relative accuracy of source measurement systems during hazardous-waste trial burn tests and ambient air-monitoring programs; (2) to verify the manufacturer's certified analysis of the multicomponent gas mixtures; (3) to determine the stability of gas mixtures with time; and (4) to develop new audit materials as requested by EPA. The repository consists of 3 mixtures of 5, 8, and 9 organic compounds each. These mixtures were blended by a commercial gas supplier in aluminum cylinders in a balance gas of nitrogen. The 5-component mixture (Group I) contains carbon tetrachloride, chloroform, perchloroethylene, vinyl chloride and benzene. The 9-component mixture (Group II) includes trichloroethylene, 1,2-dichloroethane, 1,2-dibromoethane,

acetonitrile, trichlorofluoromethane (F-11), dichlorodifluoromethane (F-12), bromomethane, methyl ethyl ketone and 1,1,1-trichloroethane. The 8-component mixture (Group III) includes pyridine, vinylidene chloride, 1,1,2-trichloro 1,2,2-trifluoroethane (F-113), 1,2-dichloro 1,1,2,2-tetrafluoroethane (F-114), acetone, 1,4-dioxane, toluene, and chlorobenzene. To date 41 performance audits have been initiated and 35 are complete. The results of these audits and description of the experimental procedures used for analyses and available stability data are presented in this Status Report 2.

26237 **(PB—86-144870/XAB) EPA (Environmental Protection Agency) Complex Terrain Model Development: description of a computer data base from Small Hill Impaction Study No. 2, Hogback Ridge, New Mexico.** Truppi, L.E. (Environmental Protection Agency, Research Triangle Park, NC (USA). Atmospheric Sciences Research Lab.). Dec 1985. 99p. (EPA/600/3—86/002). NTIS, PC A05/MF A01.

The second field study of EPA's Complex Terrain Model Development Program, Small Hill Impaction Study No. 2, was conducted along a 1.5-km section of the Hogback Ridge near Farmington, New Mexico in October 1982. Eleven quantative tracer experiments were performed, each lasting 8 hours at night or early morning. Meteorological data were recorded on two instrumented towers up-wind of the ridge and two towers on the slope. Data were direct and derived measures of wind, turbulence, and temperature averaged at 5-minute and 1-hour intervals. Hourly profiles of wind, temperature, pressure and humidity were recorded at one tethersonde site upwind of the ridge, while another tethersonde was held at the point of tracer release to record wind and temperature at 13-second intervals. Three sets of optical anemometers measured path-average wind speed across the base, slope and crest of the ridge. Tracer gas concentrations, SF_6 and Freon 13B1, were detected by a network of 110 sampler sites on the ridge, and the values were recorded as 10-minute and 1-hour concentrations. All data, meteorological and tracer, were stored on magnetic tape files to form an accessible computer data base. Tape files were fully documented to facilitate utilization of the data base for modeling efforts.

26238 **(PB—86-145083/XAB) Revised standards for basic oxygen process furnaces - background information for promulgated standards. Final environmental impact statement. Final report.** (Environmental Protection Agency, Research Triangle Park, NC (USA). Emission Standards and Engineering Div.). Dec 1985. 67p. (EPA/450/3—82/005B). NTIS, PC A04/MF A01.

A New Source Performance Standard for secondary emissions of particulate matter from basic oxygen process furnace (BOPF) steelmaking shops is being promulgated under authority of Section 111 of the Clean Air Act. This final action is applicable to secondary emissions from any top-blown BOPF and to any hot metal transfer station or skimming station used for a bottom-blown or top-blown BOPF, for which construction, reconstruction, or modification commenced after January 20, 1983. The purpose of the final standard is to minimize BOPF secondary particulate emissions to the level attainable with the best demonstrated technology.

26239 **(PB—86-145422/XAB) PIC (products of incomplete combustion) formation under pyrolytic and starved-air conditions. Report for October 1984-October 1985.** Dellinger, B.; Hall, D.L.; Graham, J.L.; Mazer, S.L.; Rubey, W.A. (Dayton Univ., OH (USA). Research Inst.). Jan 1986. 57p. NTIS, PC A04/MF A01.

A comprehensive program of laboratory studies based on the non-flame mode of thermal decomposition produced much data on PIC (Products of Incomplete Combustion) formation, primarily under pyrolytic and starved-air conditions. Most significantly, laboratory results from non-flame studies were compared to those from various field tests to evaluate incinerability relationships. Measurement of gas-phase thermal stability in an atmosphere of low oxygen concentration yielded results of incinerability ranking that were far more consistent with the findings from field tests than any one of several common methods applied in the past such as those that employed heat of combustion, autoignition temperature, etc. The results of four experimental studies were presented as significant contributions to developing/expanding the data base on POHC (Principal Organic Hazardous Constituent) stability and PIC formation for pure compounds and mixtures.

26240 **(PB—86-145547/XAB) Validation of the volatile organic sampling train (VOST) protocol. Volume 1. Laboratory validation phase. Final report.** Logan, T.J.; Fuerst, R.G.; Midgett, M.R.; Prohaska, J. (PEI Associates, Inc., Cincinnati, OH (USA)). Jan 1986. 293p. NTIS, PC A13/MF A01.

The measurement of volatile organic emissions from a hazardous-waste incinerator is one of the more-difficult source testing problems. Specific compounds called principal organic hazardous constituents (POHC) are to be identified and quantified at levels of 0.5 to 100 ppb in hot, wet incinerator exhaust gas, which may also contain high particulate and acid levels. The protocol, which describes the practices used by laboratories making these measurements, allows for several alternative designs and operating procedures. The paper describes an experimental program to evaluate under controlled conditions in the laboratory as many of the acceptable practices as possible. It describes the results of sampling at various concentration levels using two tube configurations, two moisture levels and other procedural variations. These results have led to conclusions about the specific VOST procedures to be followed during the field-validation studies.

26241 **(PB—86-145554/XAB) Validation of the volatile organic sampling train (VOST) protocol. Volume 2. Field validation phase. Final report.** Logan, T.J.; Fuerst, R.G.; Midgett, M.R.; Prohaska, J. (PEI Associates, Inc., Cincinnati, OH (USA)). Jan 1986. 304p. NTIS, PC A14/MF A01.

With the development of the Volatile Organic Sampling Train (VOST) Protocol (February 1984) to measure organic emissions from hazardous-waste incinerators, a wide variety of compounds have been collected and analyzed. Because its use is currently being recommended by regulatory agencies to measure emissions for compliance determinations, the VOST Protocol must be subjected to a methods validation study. The VOST validation program consists of two phases: laboratory validation studies and field-test validation studies. The report documents the results of the field-test validation phase. Because of the variety of organic compounds to which this method will inevitably be applied, the almost unlimited number of permutations that could be conceived made a comprehensive validation impractical. Recommendations relative to method improvements, quality-assurance measures and other aspects of VOST sampling and analysis procedures are also discussed.

26242 **(PB—86-145661/XAB) Gaseous HC1 and chlorinated organic compound emissions from refuse-fired waste-to-energy systems. Final report.** Nunn, A.B. (Scott Environmental Technology, Inc., Plumsteadville, PA (USA)). Jan 1986. 76p. NTIS, PC A05/MF A01.

The emissions from a water-wall mass-fired municipal-waste incinerator and a refuse-derived-fuel (RDF) fired incinerator were sampled for chlorinated organic compounds and hydrochloric acid (HCl). The sampling was performed to evaluate the extractive sampling methods used to measure the compounds. Sampling the chlorinated organic compound emissions was conducted using a modified version of the EPA Reference 5 Method, which included an XAD-2 resin cartridge. HC1 was sampled with an impinger train using basic absorbing solutions. The recovered chlorinated organics were separated into chlorophenols, chlorobenzenes, poly-chlorinated biphenyls (PCBs), chlorinated dibenzo-p-dioxins (CDDs), and chlorinated dibenzofurans (CDFs), and quantitated. The results of the analysis are presented in terms of the compounds distributions within the sampling systems as well as the emission rates.

26243 **(PB—86-145802/XAB) Primary photochemical processes of acrolein. Final report.** Gardner, E.P.; Sperry, P.D.; Calvert, J.G. (National Center for Atmospheric Research, Boulder, CO (USA)). Jan 1986. 104p. NTIS, PC A06/MF A01.

Pollutants are removed from the atmosphere in a number of ways: they can react with OH and O_3, they can be dry and wet deposited, photodissociate through solar radiation, or they can be biodegraded. The report presents the photodissociation processes of

acrolein. Quantum yields of acrolein loss are given. The dominant reactions in the lower troposphere are the formation of C_2H_4 and CO. Also produced are CH_2-CHCHO, H, CH_2CH, and HCO radicals but at lower quantum yields. Since the OH attack on acrolein is quite large (1.9×10^{11} cu cm/molec s), ambient levels of OH (about 10^6 molecules/cu cm) will remove acrolein very rapidly (usually, about 15 hours). Thus, the major loss mechanism of acrolein in the troposphere is through OH attack, and the photodissociation process is of negligible importance.

26244 **(PB—86-147923/XAB) Sampling and analysis protocol for assessing organic emissions from stationary combustion sources in exposure evaluation division combustion studies. Methods manual.** Stanley, J.S.; Haile, C.L.; Small, A.M.; Olson, E.P. (Midwest Research Inst., Kansas City, MO (USA)). Jan 1982. 40p. NTIS, PC A03/MF A01.

The sampling and analysis methods described in the report were specifically designed for use in an ongoing nationwide survey of emissions of organic pollutants from stationary combustion sources. The primary focus of the survey is on polynuclear aromatic hydrocarbons (PAHs) and polychlorinated aromatic hydrocarbons including polychlorinated biphenyls (PCBs), polychlorinated dibenzo-p-dioxins (PCDDs), and polychlorinated dibenzofurans (PCDFs). To date, these procedures have been used by Midwest Research Institute (MRI) to survey emissions from coal-fired utility boilers, a co-fired (coal + refuse-derived fuel) utility boiler, and a municipal refuse incinerator. The document was prepared by MRI as a guideline for laboratories who may participate in the study, and for other researchers who wish to use these methods.

26245 **(PB—86-166600/XAB) Estimating interroom contaminant movements.** Walton, G.N. (National Bureau of Standards, Washington, DC (USA). Center for Building Technology). Nov 1985. 26p. (NBSIR—85/3229). NTIS, PC A03/MF A01.

Development of infiltration and interroom airflow calculation methods, driven by a concern for indoor air quality have led to a computer simulation of interroom contaminant movement. The model, which assumes fully mixed room air, shows that open doorways provide rapid mixing between rooms in buildings using forced air heating. It also confirms that it is most energy efficient to remove the contaminant nearest its source. Detailed modeling of the variations in contaminant concentration within a room is not presently feasible. The concept of ventilation effectiveness should provide sufficient accuracy and reasonable computing speed to be added to some existing energy analysis programs. Current energy analysis programs with long timesteps tend to run into convergence problems when solving the system performance and interroom airflows simultaneously. Short timestep simulation may be required. The need for computer modeling is demonstrated by the subtle behavior of a very simple system which removes contaminants by forced ventilation.

26246 **(PB—86-166626/XAB) Indoor air quality modeling, Phase 1 report. Framework for development of general models.** McNall, P.; Walton, G.; Silberstein, S.; Axley, J.; Ishiguro, K. (National Bureau of Standards, Washington, DC (USA). Building Physics Div.). Oct 1985. 65p. (NBSIR—85/3265). NTIS, PC A04/MF A01.

The report presents a framework for the development of a model for predicting the indoor air pollutant concentrations in a variety of building types under practical conditions of weather, building occupancy, building construction, and pollutant source strength. The general concepts needed for developing an indoor air-quality model are treated. Examples of the current state of indoor air-quality models are given. The pollutants discussed are formaldehyde, radon, nitrogen oxides, tobacco smoke, particulates, carbon dioxide, and carbon monoxide.

26247 **(SAND—86-0221C) Balloon tracer for atmospheric pollutants.** Lichfield, E.W.; Ivey, M.D.; Zak, B.D.; Church, H.W. (Sandia National Labs., Albuquerque, NM (USA); Technadyne Engineering Consultants, Albuquerque, NM (USA); Telemetrics Southwest, Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 11p. (CONF-8509254—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86007144.

From ARGOS users conference; New Orleans, LA, USA (23 Sep 1985).

An operational prototype of the Balloon Tracer was developed and described. This prototype was designed to be capable of meeting all of the desired specifications for the Balloon Tracer. Its buoyancy adjustment subsystem is shown. Three Gilian instrument pumps operating in parallel provide a flow of about 12 litres per minute, depending upon backpressure. The miniature Klippard mechanical valves are actuated by a servo mechanism which only requires power when the state of the valves is being changed. The balloon itself for the operational prototype is just under 3 meters in diameter. A block diagram of the operational prototype payload measures ambient pressure, temperature, and humidity obtained from AIR which outputs its data in ASCII format. The vertical anemometer, which has a measured starting speed of under 2 cm/s, makes use of a Gill styrofoam propeller and a Spaulding Instruments rotation sendor. The command decoder is built around a chip developed originally for remote control television tuners. The command receiver operating on 13.8035 MHz was developed and built by Hock Engineering. The Argos transmitter is a Telonics platform transmitter terminal. The heart of the control system is an Intel 8052AH BASIC microcomputer with both random access and read only memory.

26248 **(SAND—86-0449C) Kilauea volcano: the degassing of a hot spot.** Gerlach, T.M. (Sandia National Labs., Albuquerque, NM (USA)). Mar 1986. Contract AC04-76DP00789. 13p. (CONF-860383—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86007708.

From Norman D. Watson symposium on environmental impact of volcanism; Kingston, RI, USA (12 Mar 1986).

Hot spots such as Kilauea volcano can degas by a one-stage eruptive process or a two-stage process involving eruptive and noneruptive degassing. One stage degassing occurs during sustained summit eruptions and causes a direct environmental impact. Although generally less efficient than the one-stage degassing process, two stage degassing can cause 1 to 2 orders of magnitude greater impact in just a few hours during flank eruptions. Hot spot volcanos with resupplied crustal magma chambers may be capable of maintaining an equivalent impact from CO_2 and S outgassing during both eruptive and noneruptive periods. On average, a hot spot volcano such as Kilauea is a minor polluter compared to man.

26249 **(TVA/ONRED/AWR—85/23) Review of Tennessee Valley residential wood combustion investigations and control options assessment.** Malo, J.E.; Imhoff, R.E.; Manning, J.A.; Phillips, J.W.; Bohac, C.E. (Tennessee Valley Authority, Muscle Shoals, AL (USA). Office of Natural Resources and Economic Development). Feb 1985. 52p. NTIS, PC A04/MF A01. File Number DE86901135.

The surge in popularity of residential wood combustion (RWC) over the past few years has caused air quality problems in certain areas. These installations are characterized by airtight stoves or fireplace inserts which emit large quantities of particulates and carbon monoxide (CO), and small quantities of nitrogen oxides (NO/sub x/). The Biomass Integrated Environmental Assessment Project has supported investigations to estimate the extent of the RWC problem in the Tennessee Valley. This report summarizes the results of those investigations and evaluates alternatives for controlling RWC in the general context of the Tennessee Valley Region. 23 refs., 2 figs., 4 tabs.

26250 **(TVA/PE/CEM—85/84) Tennessee Valley Authority/Consumer Product Safety Commission. Indoor air quality study. Volume I.** (Tennessee Valley Authority, Chattanooga (USA). Energy Use Test Facility Staff). Aug 1985. 256p. NTIS, PC A12/MF A01. File Number DE86900920.

The study addressed the concern over indoor air quality as affected by the use of a non-airtight wood heaters in a relatively tight, unoccupied home. The results of this study, along with earlier testing by TVA and others, associated with wood heater emissions, will serve as a data base for considering the effect of wood heaters on indoor air quality. The test program was performed using a well insulated, single story modular home with a low air exchange rate as the test home (the same home as was used in the 1983 study). Three different types of non-airtight wood heaters

were tested during the study, which was conducted during the winter months of calender year 1984. 44 refs., 93 figs., 40 tabs.

26251 (VW-FMT—8403V/5) Methods for analyzing nitroderivatives of PAH in car exhaust. (Volkswagenwerk A.G., Wolfsburg (Germany, F.R.)). 14 Mar 1984. 60p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE86751463.

In the field of diesel exhaust, it is assumed that nitro-PAH contribute considerably to the biological impact of diesel particle extracts. The most important of these substances are nitropyrenes, especially 1-nitropyrene, which occur in diesel particles in varying concentrations but always in the ppb range. Gas chromatography using a selective nitrogen detector (TID) and liquid phase chromatography with fluorescence detection after on-line reduction in a catalytic column are two techniques for fast and reproducible measurement of the 1-nitropyrene concentration over the whole concentration range (up to about 1 ppb). A separation technique optimized for nitro-PAH saves time and materials for purification and pre-separation of the exhaust samples.

26252 Thermophoretic separation of aerosol particles from a sampled gas stream. Poztman, A.K. (to Dept. of Energy). US Patent 4,572,007. 25 Feb 1986. Filed date 7 Sep 1984. vp.

A method is described for separating aerosol particles from a gas sample being withdrawn from a contained atmosphere, comprising the following steps: placing within the contained atmosphere a covering gas impermeable enclosure have an interior chamber partly defined by a bottom metal plate that is permeable to gas; fixing the position of the enclosure with the plate facing downwardly and directly exposed to the contained atmosphere; heating the metal plate to a temperature greater than that of the contained atmosphere, whereby aerosol particles are repelled to the resulting thermophoretic forces applied to them by the temperature gradient produced in the atmosphere immediately under the plate; and sampling gas within the interior chamber of the enclosure.

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REFER ALSO TO CITATION(S) 25436, 25437, 25536, 26111, 26112, 26118, 26157, 26276, 26277, 26314

26253 (EGG-M—25385) Intrepretation of work area and environmental sampling. Ritter, P.D.; Alvarez, J.L.; Novick, V.J. (Idaho National Engineering Lab., Idaho Falls (USA)). 1985. Contract AC07-76ID01570. 15p. (CONF-8510235—5). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86007663.

From Workplace aerosol monitoring workshop; Napa, CA, USA (28 Oct 1985).

Meaningful interpretation of widely variable airborne contamination measurements is a difficult problem. Exposure limits, action levels, etc., are rigid interpretations of inherently variable environmental or workplace conditions, and are useful for control and regulatory compliance evaluations. Such limits force actions to reduce contamination, but have limited usefulness as benchmarks for evaluating isolated or nonrepresentative measurements. This paper deals with interpretation of exposure based on nonrepresentative sampling. The use of hard limits for interpreting measurements of legal record simplifies judgment during cursory audits; more aggressive questioning of the validity of these records may effectively invalidate them in a courtroom situation.

26254 (EGG-M—25585) Evaluation of personal air sampling pumps. Ritter, P.D.; Novick, V.J.; Alvarez, J.L.; Huntsman, B.L. (Idaho National Engineering Lab., Idaho Falls (USA)). 1985. Contract AC07-76ID01570. 17p. (CONF-8510235—4). NTIS, PC A02/MF A01 - GPO. File Number TI86007661.

From Workplace aerosol monitoring workshop; Napa, CA, USA (28 Oct 1985).

Personal air samplers are used for more convenient breathing zone sampling of individuals over several hour time periods. Personal air sampling pumps must meet minimum performance levels under all working conditions to be suitable for use in radiation protection programs. In addition, the pumps should be simple to operate and as comfortable to wear as possible. This is a report of testing of nine models of personal air sampling pumps, to evaluate their performance and other characteristics. 3 refs., 2 figs., 5 tabs.

26255 (TVA/ONRED/AWR—85/5) Effect of the use of gasohol on ozone formation for cities in the Tennessee Valley region. Bailey, E.M.; Meagher, J.F. (Tennessee Valley Authority, Muscle Shoals, AL (USA). Office of Natural Resources and Economic Development). Feb 1985. 95p. NTIS, PC A05/MF A01. File Number DE86901132.

The effect on ozone formation of conversion from gasoline to gasohol would be minimal unless gasohol significantly effects the emissions control devices. Since gasohol-fueled vehicles have higher evaporative emissions than gasoline-fueled vehicles, increases in ozone formation of a few percent would be anticipated if the charcoal canisters used for controlling evaporative emissions were degraded by use of gasohol. Larger increases in ozone formation would result if use of gasohol resulted in deterioration of catalytic converters. Changes in ozone formation due to conversion from gasoline to gasohol will be greater (~3%) under episodic conditions than under typical ambient conditions. The use of gasohol which has been blended for volatility control will not significantly reduce ozone formation relative to use of unadjusted gasohol. Initial ambient HC and NO/sub x/ concentration has an important effect on the change in ozone formation caused by conversion from gasoline to gasohol. The largest effects on ozone formation were seen at high ratios of ambient NO/sub x//HC. This fact indicates that cities in which the emissions have characteristically high NO/sub x//HC ratios would experience the greatest effect due to the conversion from gasoline to gasohol. 48 refs., 10 figs., 11 tabs.

5006 Regulations

REFER ALSO TO CITATION(S) 25839, 26153

26256 (EPA—450/3-85-013) Opacity provisions: background information for promulgated amendments. (Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Air Quality Planning and Standards). Dec 1985. 58p. NTIS, PC A04/ MF A01. File Number TI86900480.

On July 31, 1984, the US Environmental Protection Agency (EPA) proposed a requirement for owners and operators of affected facilities subject to opacity standards in 40 CFR Part 60 to conduct opacity observations, and record and report the opacity of emissions during each performance test as required by Section 114 of the Clean Air Act, as amended, and was based on the Administrator's determination that the recordkeeping and reporting was necessary to demonstrate compliance with the respective opacity standards. The data would also be used during 4-year reviews of standards of performance for new stationary sources so that EPA could decide whether revisions to the respective opacity standards were necessary. The proposed opacity provisions were published in the Federal Register (49 FR 30676). A hearing was not requested. Comments were received from industry, state and local air pollution control agencies, and a law firm representing members of the Utility Air Regulatory Group (UARG). The summary of comments and responses serves as the basis for the revisions made to the opacity provisions between proposal and promulgation.

26257 (EPA—450/3-85-019a) Surface coating of plastic parts for business machines: background information for proposed standards. Draft environmental impact statement. Farmer, J.R. (Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Air Quality Planning and Standards). Dec 1985. 267p. NTIS, PC A12/MF A01. File Number TI86900578.

This background information document (BID) supports proposal of the new source performance standard (NSPS) for emissions of volatile organic compounds (VOC's) from facilities that surface coat plastic parts for business machines. The development of standards of performance for new, modified, or reconstructed stationary sources of air pollution was dictated by Section 111 of the Clean Air Act (42 USC 7411), as amended. The plastic parts coating

process emits VOC's. These VOC's participate in atmospheric photochemical reactions to produce ozone and other photochemical oxidants which contribute significantly to air pollution. The sources of the VOC emissions are the decorative and protective coatings used on the exterior surface of plastic parts and the metal-filled electromagnetic interference/radio-frequency interference shielding coatings used on the interior surface of plastic parts. The VOC's used in these coatings evaporate into the atmosphere as the coating dries. Regulatory alternatives to reduce VOC emissions were considered. Control options for EMI/RFI shielding and exterior coating are discussed separately.

26258 **(GAO/RCED—85-129) EPA-approved revisions to state implementation plans allowing increased sulfur dioxide emissions were legal.** (General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div.). 16 Aug 1985. 31p. General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760. File Number TI86900599.

Report to The Chairman, Subcommittee on Oversight and Investigations, Committee on Energy and Commerce, House of Representatives.

GAO found that the revisions allowed a net increase of 1.5 million tons of sulfur dioxide emissions during calendar years 1981-83. Based on a sample of the revised plans, GAO also found that EPA and the states had determined that the increases in emissions would not violate national standards and, thus, were consistent with key act requirements. GAO does note that EPA's approval decisions were based on some uncertainties, which EPA is currently assessing.

26259 **(NILU-TR—5/85) Photochemical oxidant control strategies in Europe. A 19 days' case study using a Langrangian model with chemistry.** Hov, O.; Stordal, F.; Eliassen, A. (Norsk Inst. for Luftforskning, Lillestroem). Feb 1985. 40p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86751550.

The Norwegian Lagrangian trajectory model with atmospheric boundary layer chemistry has been applied to calculate the transport of oxidants to nine receptor points 150 km apart in southern Scandinavia during the period 26 August to 14 September 1980. Ozone and PAN measurements at several rural sites have been used for comparison, and the calculated ozone concentrations at the nine points during the 19 days' period compare well with the measurements. The most important factors which control long-range transport of ozone and PAN seem to be well described. Hydrocarbon emission control in Europe is calculated to cause substantial decrease of the ozone concentrations in southern Scandinavia on days with high-oxidant levels. Control of NOsub(x) only or NOsub(x) and hydrocarbons in combination are much less efficient as strategies to reduce oxidant levels. 28 references.

26260 **(PB—86-119906/XAB) Carbon monoxide analysis of future attainment of the NAAQS (National Ambient Air Quality Standard) in Wichita, Kansas. Final report.** Schewe, G.J. (PEI Associates, Inc., Cincinnati, OH (USA)). Jun 1985. 110p. NTIS, PC A06/MF A01.

In order to comply with the NAAQS for CO in Wichita, Kansas, a special study was performed to demonstrate that CO concentrations at a special purpose monitor (SPM) located near Douglas and Main Streets would give results less than the NAAQS by 1987. The SPM site is located near the urban core in an area characterized by high nighttime traffic volumes and congested traffic flow. Exceedances of the 8-hour NAAQS were measured in 1983 and early 1984 with no exceedances since January 8, 1984. A dispersion modeling analysis was performed using the CALINE-3 Model for dispersion, the MOBILE-3 Model for vehicle emissions and local or national traffic and ambient conditions. Background concentrations were derived from other monitors in the area. Results of modeling the SPM site for baseline (1983) emissions were calibrated with maximum measured CO concentrations. Several scenarios were analyzed in this analysis including with and without the inspection/maintenance program and with and without the left-turn ban from Douglas to Main Streets. Results indicate attainment in 1985 continuing through 1987 if I/M is maintained.

26261 **(PB—86-137403/XAB) Maps depicting nonattainment areas pursuant to Section 107 of the Clean Air Act - 1985.** Yarn, J.; Beal, W.; Tate, C. (Environmental Protection Agency, Research Triangle Park, NC (USA). Control Programs Development Div.). Sep 1985. 245p. (EPA/450/2—85/006). NTIS, PC A11/MF A01.

The report is a detailed mapping of the United States depicting those areas nonattaining the National Ambient Air Quality Standards for carbon monoxide, nitrogen dioxide, ozone, sulfur dioxide, and total suspended particulates. It includes nonattainment area maps and supporting lists from Federal Register publications for final actions through September 1, 1985.

26262 **(PB—86-140589/XAB) Compilation guide of procedural decisions on EPA NSPS (Environmental Protection Agency New Source Performance Standards) reference methods. Final report.** DeWees, W. (PEDCo-Environmental, Inc., Cincinnati, OH (USA)). Sep 1984. 102p. NTIS, PC A06/MF A01.

The manual presents a compilation of the past-performance test procedural decisions. The manual also explains how alternative procedures and methods should be submitted for review and approval and documentation. Finally, the manual provides a list of example issues related to performance testing and the corresponding responses from the EPA Regional Offices.

26263 **(PB—86-143880/XAB) Enforcement in the 80's: compliance with environmental laws.** (Environmental Protection Agency, Seattle, WA (USA)). Oct 1985. 33p. (EPA/910/9—85/138). NTIS, PC A03/MF A01.

The report compares environmental enforcement data in the Pacific Northwest from Fiscal Year 1982 through Fiscal Year 1984. Section I covers combined state-EPA enforcement efforts. Section II documents the increased vigor of state enforcement programs. Section III focuses on work by the Region 10 Office.

26264 **(PB—86-147899/XAB) Opacity provisions: background information for promulgated amendments. Final report.** (Environmental Protection Agency, Research Triangle Park, NC (USA). Emission Standards and Engineering Div.). Dec 1985. 48p. (EPA/450/3—85/013). NTIS, PC A03/MF A01.

The promulgated opacity provisions require owners or operators of affected facilities that are subject to opacity standards in 40 CFR Part 60 to record and report the opacity of emissions during the initial performance test. These provisions implement Section 114 of the Clean Air Act.

51 ENVIRONMENTAL SCIENCES, TERRESTRIAL

5101 Basic Studies

REFER ALSO TO CITATION(S) 25463, 25467, 26350

26265 **(DOE/ER/60297—2) Compensatory mortality in mule deer populations. Technical progress report.** White, G.C. (Colorado State Univ., Fort Collins (USA). Dept. of Fishery and Wildlife Biology). 15 Mar 1986. Contract FG02-85ER60297. 15p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86008966.

The hypothesis of compensatory mortality is critical to understanding population dynamics of wildlife species. This is vital regardless of whether populations are managed for recreational hunting or habitats are altered via energy development projects. The purpose of research summarized herein is to test for compensatory mortality during winter in the juvenile (fawn) portion of a mule deer population. In the fall of 1985, sixty fawns were radio collared on both the control and treatment sites of the Little Hills study area. Thirty-three adult females also were telemetered, bringing the total instrumented population to 167 at the onset of winter. 10 refs., 1 fig., 6 tabs.

26266 (KFK-PEF—2, pp 215-227) **Ion equilibria in mineral soils of spruce sites with Ca, Mg and K deficiencies detected by needle analysis.** Hildebrand, E.E. (Forstliche Versuchs- und Forschungsanstalt Baden-Wuerttemberg, Freiburg im Breisgau, Germany, F.R.). Apr 1985. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86751479. (CONF-8503225—).

From 1. status colloquium of the European Research Center project for air pollution abatement measures (PEF) of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (5 Mar 1985).

The demonstration of ion equilibria in mineral soils by GAPON co-efficients shows both the capacity of alkali nutrient elements and the intensity of their exchange rates to decrease with increasing occupation of exchangers with trivalent cationic acids. The exchange rate of bases will increase again with the onset of protonization of the exchangers, with the capacity of the exchangeable bases either settling down at a level of 'reserve ration' or decreasing even further. At three sites Mg deficiency and Ca supply shortage were found by needle analysis under this chemical soil condition, viz. at reduced base capacity and at protone-related increase of exchange rate. At all sites studied, K equilibria are not influenced by the known sterically conditioned preference of sorption to the lattices of phyllosilicates. The conclusion is that the exchanger surfaces have been changed by acidification processes in such a way that permanent lattice charges as factors of K linkage can no longer be detected. The cationic equilibria in the mineral soils of the sites studied explain the difficulty of increasing alkali saturation in the mineral soil by fertilizing forests in an economic and environmentally neutral way.

26267 (RISO-M—2549) **Present soil data for the ECCES-program system.** Mortensen, P.B. (Risoe National Lab., Roskilde (Denmark)). Jan 1986. 34p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86751509.

EFP-85.

This is a status report that presents area and soil data, soil characteristics and input data used in the ECCES-program system for Danish arable soils. Input of ions to the upper soil layer with rain, fertilizer and lime are described together with the parameters used to describe the properties of different soil types. Together with a series of other reports, this report forms part of the description of the ECCES-model developed at Risoe National Laboratory.

26268 (TVA/ONRED/AWR—85/10) **Agricultural fuel crops: 201-County Tennessee Valley region policy assessment.** D'Souza, G.E.; Bohac, C.E. (Tennessee Valley Authority, Chattanooga (USA). Office of Natural Resources and Economic Development). Oct 1985. 88p. NTIS, PC A05/MF A01. File Number DE86901134.

Almost no fuel can be produced without environmental implications. Similarly, the production of crops for fuel is associated with certain externalities. The primary one is the erosive nature of some of these fuel crops, causing a long-term loss in soil productivity. This environmental spillover was examined within the framework of two fuel crop production scenarios, impacts from these scenarios assumed to be the upper bounds for those that could possibly occur. Corn was used as a surrogate crop for the assessment, which was limited to the 201 counties of the Tennessee Valley region, and included a timeframe extending to the year 2000. Due to the paucity of data and time limitations, a large portion of this discussion was based more on casual observation rather than hard empirical evidence. 30 refs., 1 fig., 2 tabs.

26269 **Suspended sediment in rapid subsurface stormflow on a large field plot.** Pilgrim, D.J.; Huff, D.D. (Univ. of New South Wales, Kensington, Australia). *Earth Surface Processes and Landforms;* 8: 451-463(1983).

The occurrence of rapid movement of suspended sediment in subsurface stormflow on a large field plot in California is described. Concentrations of over 1000 mg l^{-1} were recorded in storms of only low to moderate intensity. The observed sediment was composed of uniformly fine-sized particles 4 to 8 μm in diameter. The mode of transport seems different from processes previously reported. Differences in sediment concentrations in different events, levels of ^{137}Cs on the sediment, and several other types of evidence indicate that the sediment was detached and entrained at the ground surface by raindrop impact and that the water and sediment flow occurred mainly through macropores in the soil. As conditions similar to those at the study site are not uncommon, it seems probable that the phenomenon may occur in many regions. 35 references, 3 figures, 2 tables.

5102 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 25327, 25361, 26176, 26285, 26286, 26287, 26288, 26292, 26302, 26305, 26361, 26378

26270 (AD-A—162364/4/XAB) **Installation restoration program, Phase I: records search, Francis E. Warren Air Force Base, Wyoming. Final report.** Schroeder, E.J.; Palumbo, D.A.; Stephens, R.D.; McAuliffe, J.P. (Engineering-Science, Inc., Atlanta, GA (USA)). Sep 1985. 215p. NTIS, PC A10/MF A01.

This report identified and evaluated several potentially hazardous waste-disposal sites at F E Warren AFB. Records of past waste handling and disposal practices were reviewed. Interviews with past and present installation employees were conducted to develop a history of waste disposal practices. The environmental setting was evaluated including soils, geology, groundwater, and surface water. Five landfills, six spill sites, two fire-protection training areas and an acid dry well were found to have sufficient potential to create environmental contamination; follow-on investigations (Phase II) were recommended and outlined.

26271 (NP—6751520) **Effects of sulfur compounds and other air pollutants on soil and ground water.** Nihlgaard, B.; Tyler, G.; Nilsson, I. (United Nations, Geneva (Switzerland). Economic Commission for Europe). 1984. 21p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86751520.

This report deals with biological and chemical effects of air pollution (in particular, acidic and acidifying compounds and heavy metals) on soils, which are not intensively managed. The points covered will include: - Important physical and chemical properties of soils affecting their sensitivity to acidification; - Effects of acid and acidifying substances on soil pH and acidity; - Effects on mobile anion availability and cation leaching; - Effects on nutrient supply and cycling; - Effects on metal mobilization and toxicity; - Effects on soil biota and decomposition/mineralization activities; - Relationship between soil acidification and its fertility for forests and cultivated crops; - Prediction of soil effects. The account is mainly based on publishing information and research reports from the countries of northern and western Europe, United States and Canada. 57 references.

26272 (PB—86-112414/XAB) **SESOIL execution using the data management supporting systems, SESIN and SESOILFM. User's guide.** (General Software Corp., Landover, MD (USA)). 26 Dec 1984. 65p. NTIS, PC A04/MF A01.

SESOIL, a soil compartment model, estimates the rate of chemical transport/transformation from the soil surface to groundwater in terms of mass and concentration distributions among the soil, water, and air phases.

26273 (PB—86-125580/XAB) **Permit Writers Guidance Manual for hazardous-waste land storage and disposal facilities. Phase 1. Criteria for location acceptability and existing applicable regulations. Final draft report.** (Environmental Protection Agency, Washington, DC (USA). Office of Solid Waste and Emergency Response). Feb 1985. 177p. (EPA/530/SW—85/024). NTIS, PC A09/MF A01.

The Permit Writers Guidance Manual for the Location of Hazardous Waste Land Treatment, Storage, and Disposal Facilities has three purposes: (1) to provide guidance in defining acceptable physical locations for hazardous-waste land treatment, storage, and disposal (HWLTSD) units, (2) to cite available regulations and statutes and how these should be applied in evaluating the acceptability of locations, and (3) to present an outline summary of future Agency efforts to ensure both proper site analysis and safe location of such facilities. The intended audience is EPA Regional Office

staff and authorized State Agency personnel who evaluate permit applications under the authority of the Resource Conservation and Recovery Act (RCRA). Part of a broad program to encourage safe and proper siting of hazardous waste facilities, this manual is the first of a five-document series.

26274 **(PB—86-135175/XAB) Single-laboratory evaluation of the RCRA (Resource Conservation and Recovery Act) method for analysis of dioxin in hazardous waste.** Shore, F.L.; Vonnahme, T.L.; Hedin, C.M.; Donnelly, J.R.; Niederhut, W.J. (Lockheed Engineering and Management Services Co., Inc., Las Vegas, NV (USA)). Nov 1985. 68p. NTIS, PC A04/MF A01.

Single-laboratory testing of RCRA Method 8280 for the analysis of chlorinated dibenzop-dioxins and dibenzofurans has been initiated on sample matrices including pottery clay soil, a Missouri soil, a fly ash, a still bottom from a chlorophenol-based herbicide production process, and an industrial process sludge. The analytical method was intended for use in the determination of chlorinated dioxin and dibenzofuran homologs with four, five, or six chlorine atoms per molecule. Revisions to the method that were found necessary for satisfactory analytical performance were developed and incorporated into a revised version of the method. Single-laboratory testing of method 8280 with minor revisions demonstrated satisfactory performance for the target analytes on soil and fly ash samples. Further modification and elaboration of sample cleanup procedures were necessary for analysis of the still bottom and industrial sludge samples.

26275 **(UCID—20662) East Traffic Circle Landfill closure report.** McConachie, W.A.; Como, J.P.; Carpenter, D.W.; Ragaini, R.C. (Lawrence Livermore National Lab., CA (USA)). 31 Jan 1986. Contract W-7405-ENG-48. 137p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE86007985.

This report presents the results of the investigation and cleanup of the East Traffic Circle Landfill (ETCL), an inactive landfill located in the east-central portion of the main site of Lawrence Livermore National Laboratory. The old landfill site was uncovered by construction workers during utility-line trenching on July 19, 1984. The uncovered debris was surveyed with radiation detection instruments, showed no radioactivity, and was found to consist primarily of metal shavings and broken bottles. An initial soil sample was taken and analyzed for metals and volatile organic compounds. Only copper, lead, and zinc were detected in some samples at levels exceeding the state hazardous waste designations. Shallow soils generally showed little (less than 0.1 ppM) volatile halogenated and non-halogenated volatile organic chemical contamination; however, a sample collected beneath 20 partially crushed metal drums showed 11 ppM of trichloroethylene (TCE) and 50 ppM of tetrachloroethylene (PCE). Soils from 21 to 51 feet beneath the drums showed TCE and PCE concentrations approaching 1 ppM each. The East Traffic Circle Landfill area was generally excavated to a depth of 5 to 7 feet below grade and to 10 or more feet in the vicinity of 160-plus capacitors. The 13,971 cubic yards of excavated soil and debris were hauled from the LLNL site by registered haulers and disposed of at state-permitted hazardous waste disposal sites. Construction activities resumed in the area after the landfill was backfilled.

5103 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 25430, 25437, 26143, 26378

26276 **(DOE/EIS—0109F) Long-term management of the existing radioactive wastes and residues at the Niagara Falls Storage Site. Final Environmental Impact Statement.** (USDOE, Washington, DC). Apr 1986. 537p. NTIS, PC A23/MF A01; GPO Dep. File Number DE86008418.

The EIS assesses and compares several alternatives for long-term management and control of the existing radioactive wastes and residues at the Niagara Falls Storage Site (NFSS), Lewiston, New York. The alternatives include: (1) no action (continued interim storage at NFSS within a diked and capped containments area), (2) long-term management at NFSS (improved containment, with or without modified form of the residues), (3) long-term management at other DOE sites (Hanford, Washington, or Oak Ridge, Tennessee), and (4) offsite management of the residues at Hanford or Oak Ridge and wither leaving the wastes at NFSS or removing them for disposal in the ocean. In addition to alternative analyzed in depth, several options are also being considered, including: other modifications of residue form (vitrification and matrix isolation methods), modification of the basic conceptual designs, other containment design options, transportation routes, and transportation modes. Alternative 2 is DOE's preferred alternative.

26277 **(DOE/EIS—0126-D-Vol.1) Remedial actions at the former Climax Uranium Company Uranium Mill Site, Grand Junction, Mesa County, Colorado. Volume 1. Text. Draft environmental impact statement.** (USDOE Albuquerque Operations Office, NM. Uranium Mill Tailings Remedial Action Project Office). Mar 1986. 259p. NTIS, PC A12/MF A01; 1; GPO Dep. File Number DE86009138.

This statement evaluates and compares the environmental impacts associated with the remedial actions of the residual radioactive materials remaining at the inactive uranium processing site and associated vicinity properties at Grand Junction, Mesa County, Colorado. The site is a 114-acre tract of private and state owned land which contains approximately 3.1 million cubic yards of tailings and associated contaminated soils. The vicinity properties are homes, businesses, public buildings, and vacant lots which may have been contaminated during construction by the use of tailings as building material. An estimated 3465 vicinity properties would be cleaned up during remedial action of the tailings pile. This statement evaluates six alternatives for stabilization and disposal of the tailings and other contaminated materials: no action; stabilization at the Grand Junction site; disposal at the Cheney Reservoir site with truck transport; disposal at the Cheney Reservoir site with train and truck transport; disposal at the Two Road site with truck transport; disposal at the Two Road site with train and truck transport. All of the alternatives except include remedial action at an estimated 3465 vicinity properties. Alternative 3 is DOE's preferred alternative. 29 figs., 25 tabs.

26278 **(DP-MS—86-3) Modeling tritium transport in the environment.** Murphy, C.E. Jr. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1986. Contract AC09-76SR00001. 28p. (CONF-860214—1). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86007160.

From Workshop on environmental and human risks of tritium; Karlsruhe, F.R. Germany (17 Feb 1986).

A model of tritium transport in the environment near an atmospheric source of tritium is presented in the general context of modeling material cycling in ecosystems. The model was developed to test hypotheses about the process involved in tritium cycling. The temporal and spatial scales of the model were picked to allow comparison to environmental monitoring data collected in the vicinity of the Savannah River Plant. Initial simulations with the model showed good agreement with monitoring data, including atmospheric and vegetation tritium concentrations. The model can also simulate values of tritium in vegetation organic matter if the key parameter distributing the source of organic hydrogen is varied to fit the data. However, because of the lack of independent conformation of the distribution parameter, there is still uncertainty about the role of organic movement of tritium in the food chain, and its effect on the dose to man.

26279 **(EPA—600/S9-85-013) Land disposal of hazardous waste: proceedings of the eleventh annual research symposium.** Zunt, D.A.; Barkley, N.P. (Environmental Protection Agency, Cincinnati, OH (USA). Hazardous Waste Engineering Research Lab.). Jul 1985. 10p. (CONF-8504122—Pt.1-Absts.). NTIS, PC A02/MF A01. File Number TI86901083.

From 11. annual solid waste research symposium; Cincinnati, OH, USA (29 Apr 1985).

Proceedings are summarized for Session A of the US Environmental Protection Agency's (EPA's) Eleventh Annual Research Symposium - Land Disposal, Remedial Action, Incineration, and Treatment of Hazardous Waste. The symposium was held in Cincinnati, Ohio April 29 through May 1, 1985. Session A, Hazardous

Waste Land Disposal, included 35 papers; and Session C included 20 poster presentations about the status of research projects sponsored by EPA's Land Pollution Control Division (LPCD) of the Hazardous Waste Engineering Research Laboratory (HWERL). Land Disposal papers are presented in the areas of remedial action, pollutant assessment, and pollutant control. They discuss the generation, movement, control, and treatment of pollutants in landfills, surface impoundments, air, underground mines, and uncontrolled remedial action hazardous waste sites. Session B, Hazardous Waste Incineration and Treatment, will be published as a separate document.

5105 Site Resource And Use Studies

REFER ALSO TO CITATION(S) 25299, 25306, 25307, 26279

26280 (EPRI-EA—3417-Vol.3) Geohydrochemical models for solute migration. Volume 3. Evaluation of selected computer codes. Final report. Morrey, J.R.; Kincaid, C.T.; Hostetler, C.J. (Pacific Northwest Labs., Richland, WA (USA)). Mar 1986. Contract AC06-76RL01830. 299p. NTIS, PC A13/MF A01; 1 - Research Reports Center, Box 50490, Palo Alto, CA 94303; GPO Dep. File Number DE86008997.

This volume reports on the simulation of geochemistry and transport test cases based in part on actual disposal sites. It also contains a brief evaluation of a coupled geohydrochemical code based on column studies of solute transport. These simulations have been conducted with two geochemistry codes (EQ3NR/EQ6 and MINTEQ), three flow and transport codes (SATURN, FEMWATER1/FEMWASTE1, and TRANS), and one coupled geohydrochemical code (FIESTA). Based on the results of this and related research, options are presented for the development of needed computational packages (i.e., codes) and a recommendation is made for the direction of future activity on design specifications for a geohydrochemical code for application to solute migration from utility solid-waste disposal sites.

26281 (ORNL/TM—9967/V1) Technical review of the Oak Ridge Y-12 Plant non-radiological effluent and environmental monitoring program. Volume 1. (Martin Marietta Energy Systems, Oak Ridge, TN (USA)). Feb 1986. Contract AC05-84OR21400. 77p. NTIS, PC A05/MF A01. File Number DE86007937.

Based on information reviewed in July 1985, Y-12 has some very strong areas such as chain-of-custody forms and compliance work on the new NPDES permit. The recommendations are divided into eighteen categories. Each recommendation is also divided into major or minor categories as an indication of the resources estimated to complete this recommendation. The areas needing the most improvement are air monitoring, QA/QC, field procedures, documentation, groundwater sampling, spill prevention control and countermeasures plan and biological monitoring. Recommendations are tabulated by category and by priority.

5106 Regulations

26282 (PB—86-115821/XAB) Florida coastal law and policy: cases and readings. Christie, D.R. (Florida Sea Grant Coll. Program, Gainesville (USA)). 1985. 409p. (SGR—75). NTIS, PC A18/MF A01.

The 1985 session of the Florida legislature produced landmark legislation in the area of coastal land use and resources management. The Growth Management Act and the Coastal Zone Protection Act of 1985, following on the heels of major water resources and wetlands protection acts in 1983 and 1984, can again make Florida a leader in environmental protection and coastal management. Coastal law courses are becoming common in graduate programs and law schools, and they are different because they focus on a place rather than a generally recognized field of law.

52 ENVIRONMENTAL SCIENCES, AQUATIC

5201 Basic Studies

26283 (SFB—80/T-228) Calculation of oscillatory turbulent flows in open channels. Celik, I.; Rodi, W. (Karlsruhe Univ. (T.H.) (Germany, F.R.). Sonderforschungsbereich Ausbreitungs- und Transportvorgaenge in Stroemungen). Mar 1984. 23p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86751462.

An alternating-direction implicit (ADI) type finite difference method is utilized for the calculation of the vertical structure of oscillatory turbulent flows in two-dimensional open channels. The free surface elevation is determined by using the Leap-Frog method in the first half step and an implicit method at the second half step. The turbulent shear stress is calculated with the aid of turbulence model which relates the eddy viscosity to the turbulent kinetic energy, and to the rate of its dissipation and determines the distribution of these 2 quantities from model transport equations. The empirical constants in this model are given the standard values cited in the literature and used successfully for calculating a large variety of steady flows; they are not tuned to the oscillating channel flows. Calculations performed for oscillatory laminar flows are compared with analytic solutions to ensure the proper performance of the numerical scheme. The turbulent flow in a laboratory estuary model with one end closed in the Humber Estuary is simulated with the numerical model, and the results are compared with the corresponding flume and field measurements. The influence of frequency and roughness is thereby investigated. The results indicate that the time and space variation of the velocity field and the phase lag between the surface slope and the horizontal velocity can be predicted satisfactorily in oscillatory turbulent flows.

5202 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 25306, 25307, 25346, 25347, 25348, 26176, 26270, 26272, 26273, 26323

26284 (AD-A—161201/9/XAB) Installation Restoration Program (IRP). Phase II. Confirmation/quantification, Stage 2 for Langley Air Force Base, Virginia. Final technical report, June 1984-July 1985. Adams, W.D.; Sullivan, J.H.; Fellows, C.R. (Water and Air Research, Inc., Gainesville, FL (USA)). 30 Jul 1985. 148p. NTIS MF A01.

This report describes a study of groundwater conditions at Installation Restoration Program (IRP) Site 4, Langley Air Force Base (AFB), Virginia. Site 4 is a former underground fuel storage area previously identified as a possible source of fuel contaminated soil and shallow groundwater in the immediate area. Two other possible sources of fuel were identified during the present study. One is the underground distribution system associated with the former fuel storage area. The other is an underground pipeline in current use. All three remain under consideration as possible sources of leaking fuel.

26285 (AD-A—162363/6/XAB) Installation restoration program, Phase I, records search, K.I. Sawyer AFB, Michigan. Final report. Snider, E.H.; Minicucci, S.K.; Tiffany, S.J.; Baker, J.N. (Engineering-Science, Inc., Atlanta, GA (USA)). Sep 1985. 275p. NTIS, PC A12/MF A01.

This report identified and evaluated several potentially hazardous-waste disposal sites at K I Sawyer AFB. Records of past waste handling and disposal practices were reviewed. Interviews with past and present installation employees were conducted to develop a history of waste disposal practices. The environmental setting was evaluated including soils, geology, ground water, surface water. The POL area, two fire protection training areas, four landfills, one hardfill, one drainage pond, two drainage pits, the DPDO, and the Wells Terminal Annex were found to have sufficient potential to create environmental contamination and follow-on investigations (Phase II) were recommended and outlined. (Author)

26286 (AD-A—162365/1/XAB) Installation restoration program (IRP), Phase II, Stage 1 - problem confirmation study, Norton Air Force Base, San Bernardino, California. Vvolume 1. Technical report. Final report, December 1984-July 1985. (Weston (Roy F.), Inc., West Chester, PA (USA)). Jul 1985. 189p. NTIS, PC A09/MF A01.

Fifteen sites of potential environmental concern, grouped into six waste-management zones, were evaluated. A total of 22 monitor wells were installed and groundwater samples were obtained from each well. Soil samples were obtained for chemical analysis from 12 soil borings. Samples of surface water, bottom sediments and fish tissues were obtained from three ponds. All chemical analyses were accomplished in accordance with Standard USEPA analytical methods. Based on the sampling and analyses performed, levels of contamination were found in soils or groundwater at seven of the 15 sites evaluated which warrant further investigation and potential remedial actions. Recommendations were made as to appropriate follow-up site evaluation work at these seven sites.

26287 (AD-A—162732/2/XAB) Commencement Bay nearshore/tideflats Superfund site, Tacoma, Washington remedial investigations. Evaluation of alternative dredging methods and equipment, disposal methods and sites, and site control and treatment practices for contaminated sediments. Final report. Phillips, K.E.; Malek, J.F.; Hammer, W.B. (Corps of Engineers, Seattle, WA (USA). Seattle District). Jun 1985. 233p. NTIS, PC A11/MF A01.

Alternative technologies and techniques for dredging, disposal, and treatment of contaminated sediments are reviewed. Implications of alternative technologies for management of contaminated sediments are discussed. Selection of appropriate technologies for contaminated sediments management depends on the physical and chemical profile of the sediments, and particularly on the physical state (liquid, solid, or gaseous) of contaminants of concern and changes in state that may occur at different phases of dredging, disposal, control, and treatment. Determination of acceptable criteria governing concentrations of contaminants in water, sediments, and soils, and air is the major requirement for selecting specific technologies for managing contaminated sediments. Technologies should be used which ensure that criteria will be met at all phases in the handling operations. Cost is most variable for disposal-site effluent-treatment options.

26288 (AD-A—162920/3/XAB) Installation restoration program. Phase 2. Confirmation/quantification Stage 1 for Nellis Air Force Base, Nevada. Final report, October 1983-August 1985. (Dames and Moore, Park Ridge, IL (USA)). 9 Aug 1985. 434p. NTIS, PC A19/MF A01.

The field evaluation investigated 5 sites through drilling and sampling 12 new borings and sampling 5 preexisting base wells. Two ground-water systems exist beneath the base. The shallow ground-water system comprises approximately the upper 200 feet of valley sediments. It is maintained by upward leakage from a deeper artesian aquifer and recharged by septic tank effluent, irrigation waters, and wastewater treatment plant effluent. Precipitation is an insignificant source of recharge. The deeper artesian ground-water system consists of more permeable sediments at depths greater than about 200 feet. It is the principal source of ground water for the base and the Las Vegas Valley. Of 44 parameters analyzed in ground water, only 6 were present in one or more samples above detection limits. The detected parameters included two halocarbons (1,1,1-trichloroethane and toluene), two pesticides (aldrin and DDT isomers), nitrate, and phenol. Nitrate concentration in one monitoring well sample exceeded primary drinking water standards.

26289 (CONF-7603135—1) Wastewater treatment of MTC acrylonitrile plant. Iwai, Y. (Mitsui Toatsu Chemicals, Inc., Osaka (Japan)). 1976. 28p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86900870.

From 4. acrylonitrile licensee meeting; Kaoshung, Taiwan (9 Mar 1976).

We selected a wet oxidation process as a method of treating COD and HCN in acrylonitrile plant waste water efficiently and simultaneously and in 1972 constructed a 670 m^3/d wet oxidation treatment plant which has been working well since that time.

26290 (ENEA-RT-TIB—84-8) Trace element determination in the filters used for environmental purposes. Moauro, A.; Madaro, M. (ENEA, Casaccia (Italy). Dipartimento Tecnologie Intersettorialli di Base). 1984. 11p. (CONF-831295—2). NTIS (US Sales Only), PC A02/MF A01. File Number DE86900967.

From 6. industrial hygiene convention; Rome, Italy (5 Dec 1983).

The importance of the filter, in view of the determination of trace elements in suspended particulate matter, has been verified during experimental work performed on sea and river samples. Sometimes, the element concentrations in the filters are higher than in the matrix to be analyzed. Owing to the low concentration levels of the elements to be determined, instrumental neutron activation analysis has been considered the most suitable analytical method for testing impurities in the filters. Results obtained on two different types of filters, in order to select the most suitable to the matrix under investigation.

26291 (GKSS—85/E/30) About the sorption of C-14 labelled γ-hexachlorcyclohexane (lindane) in the ng/l-range at geogene adsorbers. Wirth, H. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.); Hamburg Univ. (Germany, F.R.). Fachbereich Geowissenschaften). 1985. 181p. (In German). NTIS (US Sales Only), PC A09/MF A01. File Number DE86751101.

In order to evaluate the environmental behaviour of chlorinated hydrocarbons more precisely, laboratory adsorption experiments under defined conditions taking lindane as a model were carried out. Adsorbents used were Elbe River suspended matter, quartz, kaolinite, illite, bentonite, Na-humate and peat. Organogenic substrates showed the highest adsorption rates. Adsorption was affected by several parameters such as salinity and temperature. High remobility of lindane was found in desorption experiments. These results can be transferred to natural aquatic systems since the concentration ranges used herein are equivalent to those found in the environment. (orig.).

26292 (KFK-PEF—2, pp 199-213) **Precipitation analyses as supplementary examinations to soil and needle analyses in forest dieback research.** Evers, F.H. (Forstliche Versuchs- und Forschungsanstalt Baden-Wuerttemberg, Freiburg im Breisgau, Germany, F.R.). Apr 1985. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86751479. (CONF-8503225—).

From 1. status colloquium of the European Research Center project for air pollution abatement measures (PEF) of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (5 Mar 1985).

Precipitations containing acids and pollutants are perceived as major causative agents participating in forest dieback. Precipatation samplers were set up at ten sites in South-West Germany to obtain a preliminary overview on pollutant input in conifer stands. The results of precipitation analyses performed in the hydrological year of 1983/84 are summarized in a table, revealing elevated hydrogen ion inputs and elevated nitrogen inputs to be reckoned with locally in the Western parts of the Odenwald and Black Forest mountain ranges whereas acid input by precipitations is very much lower south of the Danube in the South-West German Alpine foothills. The same goes for other substances which are transported to a moderate extent to that region.

26293 (KFK-PEF—2, pp 285-302) **Acidification of and heavy-metal input into lakes of the Black Forest.** Zoettl, H.W.; Feger, K.H.; Brahmer, G. (Freiburg Univ., Germany, F.R. Inst. fuer Bodenkunde und Waldernaehrungslehre). Apr 1985. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86751479. (CONF-8503225—).

From 1. status colloquium of the European Research Center project for air pollution abatement measures (PEF) of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (5 Mar 1985).

In spring 1984 streams in the Black Forest with forested catchments were analysed for conductivity, pH, alkalinity (4, 3), UV-extinction (254 nm), color (436 nm), DOC (dissolved organic carbon), PO_4, NH_4, Cl, NO_3, SO_4, Na, K, Mg, Ca, Al, Fe, Mn, Zn,

Cu, Cd, und Pb. Close correlations between pH, color, DOC, and most of the heavy metals were found. Via cluster analysis of the 86 sampling sites, 3 groups were found closely correlated with the prevailing parent rocks gneiss, granite, and acidic sandstone. According to the cluster analysis of chemical parameters, a 'podzolization cluster' and a 'weathering-buffering-cluster' can be differentiated. Cl^-, SO_4^{2-}, and NO_3^- are relatively isolated in this model. Factor analysis clearly indicates influences of altitude and parent material. Thus the chemical composition of the examined streams is strongly influenced by the pedological-geological and biological site conditions. There is no evidence for a direct impact of atmospheric depositions. Still on-going investigations at 4 lakes in the Black Forest are focused on input-output studies and sediment analysis.

26294 (KFK-PEF—2, pp 303-312) **Effects of atmospheric substance input on ground water and brook water of selected woodland drainage areas in the bunter sandstone region (lower triassic) of the Black Forest mountain range.** Einsele, G. (Tuebingen Univ., Germany, F.R. Inst. und Museum fuer Geologie und Palaeontologie). Apr 1985. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86751479. (CONF-8503225—).

From 1. status colloquium of the European Research Center project for air pollution abatement measures (PEF) of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (5 Mar 1985).

The interim report covering the first three months of the study programme presents the selected drainage areas in which either a complete programme including substance balancing or critical date measurements performed on springs and small brooks were started for establishing different weather situations. A relatively dry period was analysed by means of initial samples in late autumn 1984 during which the brooks were largely fed by groundwater. The following results characterized this situation: both pH values and nitrate and sulphate concentrations document a regional trend (increased values in the Northern and Western test areas) and partly a conspicuous exposition-dependent 'asymmetry' within individual areas (e.g. at the Black Forest mountain crest). However, pH values and carbonate hardness are strongly influenced by geological conditions, too. De-acidification of spring water is observed within lengthy brook sections. Nitrate-to-sulphate ratio appears to be substantially greater in the bunter sandstone region of the Black Forest than in other regions.

26295 (PB—86-120102/XAB) **Vulnerability of selected lakes and streams in the Middle Atlantic region to acidification: a regional survey. Final report.** Arnold, D.E.; Light, R.W.; Paul, E.A. (Pennsylvania State Univ., University Park (USA). Pennsylvania Cooperative Fish and Wildlife Research Unit). Jun 1985. 149p. NTIS, PC A07/MF A01.

In conjunction with a similar study in the New England States, 278 lakes and streams in the 9 Middle Atlantic States (New York, New Jersey, Pennsylvania, Maryland, Delaware, Virginia, West Virginia, North Carolina, and Tennessee) were surveyed. Primary objectives were to document the sensitivity of these waters to acidification and to test the validity of available models and classifications for predicting their acidification. The study results indicate that a large number of relatively undisturbed waters in the Middle Atlantic States are either already acidified or are susceptible to acidification. About 49% of the unpolluted, comparatively undeveloped waters sampled were sensitive to acidification. Few of the waters showed high concentrations of aluminum, and there was only one case of a potentially toxic aluminum/pH combination.

26296 (PB—86-120433/XAB) **Southeast Atlantic coast estuaries, Sapelo Sound to St. Simons Sound, Georgia: circulation survey, 1980.** Watson, W.A. (National Ocean Service, Rockville, MD (USA)). Jan 1984. 50p. NTIS, PC A03/MF A01.

The purpose of the report is to inform potential users of the data collected during the National Ocean Service (NOS) 1980 circulation survey in the Georgia estuaries. The report presents information on station locations, periods of occupation, instruments, sampling rate, data quality, and processing procedures. The measurement of atmospheric parameters is necessary for the study of nontidal water movement caused by winds and changing atmospheric pressure. Another benefit derived from current data collected is as an aid in the prediction of oil-spill and pollutant transport.

26297 (PB—86-122496/XAB) **Water-quality assessment: a screening procedure for toxic and conventional pollutants in surface and ground water. Part 1, (revised 1985).** Mills, W.B.; Porcella, D.B.; Ungs, M.J.; Gherini, S.A.; Summers, K.V. (JACA Corp., Fort Washington, PA (USA)). Sep 1985. 638p. NTIS, PC A99/MF A01.

New technical developments in the field of water-quality assessment and a reordering of water-quality priorities prompted a revision of the first two editions of this manual. The utility of the revised manual is enhanced by the inclusion of methods to predict the transport and fate of toxic chemicals in ground water, and by methods to predict the fate of metals in rivers. In addition, major revisions were completed on Chapter 2 (organic toxicants), Chapter 3 (waste loadings), and Chapter 5 (impoundments) that reflect recent advancements in these fields. Applying the manual's simple techniques, the user is now capable of assessing the loading and fate of conventional pollutants (temperature, biochemical oxygen demand-dissolved oxygen, nutrients, and sediments) and toxic pollutants (from the U.S. EPA list of priority pollutants) in streams, impoundments, estuaries, and ground waters. The techniques are readily programmed on hand-held calculators or microcomputers. Most of the data required for using these procedures are contained in the manual.

26298 (PB—86-122504/XAB) **Water-quality assessment: a screening procedure for toxic and conventional pollutants in surface and ground water. Part 2, (revised 1985).** Mills, W.B.; Porcella, D.B.; Ungs, M.J.; Gherini, S.A.; Summers, K.V. (JACA Corp., Fort Washington, PA (USA)). Sep 1985. 496p. NTIS, PC A21/MF A01.

New technical developments in the field of water quality assessment and a reordering of water quality priorities prompted a revision of the first two editions of this manual. The utility of the revised manual is enhanced by the inclusion of methods to predict the transport and fate of toxic chemicals in ground water, and by methods to predict the fate of metals in rivers. In addition, major revisions were completed on Chapter 2 (organic toxicants), Chapter 3 (waste loadings), and Chapter 5 (impoundments) that reflect recent advancements in these fields. Applying the manual's simple techniques, the user is now capable of assessing the loading and fate of conventional pollutants (temperature, biochemical oxygen demand-dissolved oxygen, nutrients, and sediments) and toxic pollutants (from the U.S. EPA list of priority pollutants) in streams, impoundments, estuaries, and ground waters. The techniques are readily programmed on hand-held calculators or microcomputers. Most of the data required for using these procedures are contained in the manual.

26299 (PB—86-128022/XAB) **Interim protocol for diving operations in contaminated water. Final report, August 1981-October 1984.** Traver, R.P. (Environmental Protection Agency, Cincinnati, OH (USA). Hazardous Waste Engineering Research Lab.). Nov 1985. 540p. (EPA/600/2—85/130) NTIS, PC A23/MF A01.

The purpose of the research program and resulting manual have been to improve and update EPA's safety capability which involve underwater hazardous chemical cleanup responses. The manual includes the assessment, testing, evaluation, and demonstration of commercial underwater protective suits, clothing, support equipment, and breathing apparatus in water contaminated with hazardous substances that may be injurious to a diver's health. The manual also identifies specific types of in-water hazards, their location and effects upon divers, their equipment and considerations for protection surface support personnel. The major participates and beneficiaries of the program sponsored by the EPA and NOAA are the U.S. Coast Guard, U.S. Army Corps of Engineers, Department of Energy, Association of Diving Contractors, and the many local underwater search and recovery units. The helmets which were successfully evaluated for chemical exclusion were the Draeger Helmet System, the Desco Pot Diving Hat, Diving Systems International Superlite-17B Helmet, Morse Engineering MK-12 Navy Deep Water Helmet System, and Safety Sea Systems SS-20 Helmax

Helmet. Seven different suit configurations were evaluated along with the above stated helmets. One diving dress was from Draeger with the remaining six supplied by Viking Diving Systems.

26300 **(PB—86-132412/XAB) Fiscal year 1984 program report: New Hampshire Water Resources Research Center. Final report.** Byers, G.L. (New Hampshire Univ., Durham (USA). Water Resources Research Center). Sep 1985. 29p. NTIS, PC A03/MF A01.

The report covers the activities of the New Hampshire Water Resource Research Center for the period July 1984 to September 30, 1985. The results of four research projects are briefly discussed. Two of the projects relate to the acid precipitation problem, one relates to radon levels in groundwater, and one describes the social aspects of hazardous waste disposal.

26301 **(PB—86-132461/XAB) Fiscal Year 1984 program report: Kentucky Water Resources Research Institute.** (Kentucky Water Resources Research Inst., Lexington (USA)). Sep 1985. 40p. NTIS, PC A03/MF A01.

The Kentucky Water Resources Research Institute Annual Report for Fiscal Year 1984 describes the problems and issues for the Commonwealth as determined by the State Advisory Council. The program goals and priorities of the Institute describe the areas of research the program addressed. A synopsis of each of the seven research projects is included. The seven projects funded by the Institute in Fiscal Year 1984 are: For Identification of Soil-Water Chemical Parameters for the Prediction and Treatment of Suspended Solids in Surface Water Reservoirs of Coal Mine Lands; Modeling of Overland Flow by the Diffusion Wave Approach; A Model for Assessing the Visual Resources of River Basins as an Aid to Making Landuse Planning Decisions; Development of General Guidelines for the Planning of Stormwater Management Facilities; Application to Urban Watersheds in Kentucky; Reductive Dechlorination of Toxic Chlorocarbons; Investigation of Pollution in a Karst Aquifer Utilizing Optical Brightener; and Hydraulic Design Algorithms for Upgrading and Enhancing Water Distribution Systems.

26302 **(PB—86-132479/XAB) Fiscal Year 1984 program report: Maine land and water resources center.** (Maine Univ., Orono (USA). Land and Water Resources Center). Sep 1985. 30p. NTIS, PC A03/MF A01.

Contents include: effects of acidification on pond and stream macroinvertebrates; radon in houses due to radon in potable water; a comparison of the ph of coastal fogs with the ph of interior high-elevation fogs; estimating the value of river-related recreational activities: a comparison of two approaches based on case studies of the west branch of the Penobscot River and the saco river; treatment of leachate from toxic and hazardous wastes.

26303 **(PB—86-132875/XAB) Fiscal Year 1984 program report: Division of Water Resources, Rutgers - The State University, New Jersey.** (Rutgers--the State Univ., New Brunswick, NJ (USA). Center for Coastal and Environmental Studies). Sep 1985. 28p. NTIS, PC A03/MF A01.

The 1984 New Jersey Water Institute program focuses on the most critical water issue currently facing the state: the fate and effects of organic and inorganic trace contaminants in surface and ground waters. Five of the projects funded by the Program are directed toward surface waters. Four of these grants address the physical, chemical and biological factors controlling the cycling of various trace elements, particularly lead, in a variety of ecosystems, including a marsh, a swamp, several rivers and a series of acid lakes. The fifth study is determining the effects of combinations of various volatile organic contaminants on a fish species. The final project is identifying factors which influence the behavior of organic contaminants in ground water systems.

26304 **(PB—86-132917/XAB) Fiscal Year 1984 program report: Delaware Water Resources Center.** Varrin, R.D. (Delaware Univ., Newark (USA). Water Resources Center). Sep 1985. 32p. NTIS, PC A03/MF A01.

Synopses of 6 research projects of the Delaware Water Resources Center are presented. Some of the reports are: A Predictive Study for Groundwater Contamination by Petroleum Products; Fundamental Concepts of Autodigestion of Biomass; The Removal of Toxic Chemicals by Activated Carbon Process from Contaminated Groundwater; Rapid, Accurate Identification of Bacterial Pollutants in Domestic, Institutional, and Industrial Water Supplies.

26305 **(PB—86-133220/XAB) Fiscal Year 1984 program report: Pennsylvania Institute for Research on Land and Water Resources.** (Pennsylvania State Univ., University Park (USA). Inst. for Research on Land and Water Resources). Sep 1985. 38p. (LW—8507). NTIS, PC A03/MF A01.

Three Fiscal Year 1983 programs continued in Fiscal Year 1984. One program evaluated the rate and extent of recovery of a stream, dominated by the growth of aquatic vascular plants, following a program of phosphorus removal. Another attempted to determine if the chemistry of soil and soil leachate in Appalachian forests varies with the amount of acidic atmospheric deposition. A third project developed a flow-management model to explore alternative approaches to future drought protection for the Monongahela River Basin and examined possible impacts of modifications in reservoir operating policies and low-flow consumptive use restrictions.

26306 **(PB—86-133253/XAB) Fiscal Year 1984 program report: Maryland Water Resources Research Center.** (Maryland Univ., College Park (USA). Water Resources Research Center). Sep 1985. 28p. NTIS, PC A03/MF A01.

Within the framework of the 1984 Program of the Maryland Water Resources Research Center, three projects were focused on questions of pollution of surface and ground water and one on acid rain. An information-transfer project focused on the protection of ground-water supplies. In a project to assess nitrogen and phosphorus losses via subsurface ground-water flow from conventional and no-till corn watersheds, evidence was obtained that the leaching of nitrates into percolate or ground water is not enhanced by the use of no-till cultivation. No phosphate was found in percolate samples from either no-till or conventional cultivation treatments. A two-year study was conducted to assess the accumulation of toxic metals in the sediments of Maryland's Eastern Shore rivers. In a project to determine the impact on human health of contaminants present in sludge applied as soil amendment, ground and surface water have been analyzed for mutagenic compounds. Preliminary information on acidity in rainfall indicates increased levels of H(+), SO4(2-), Pb, and Mn over a control area in Tennessee.

26307 **(PB—86-134988/XAB) Overview of the resources for the Future Environmental Data Inventory: methods, sources and preliminary results. Volume 1. Final report.** Gianessi, L.P.; Peskin, H.M. (Resources for the Future, Inc., Washington, DC (USA)). Sep 1984. 127p. NTIS, PC A07/MF A01.

The Resources for the Future Environmental Data Inventory (REDI) describes discharges of 17 pollutants to the Nation's waters from over 80,000 industrial, municipal, urban, and agricultural sources. The data are indexed in sufficient detail to permit aggregation by economic sector, State, county, and hydrologic unit. Data gaps have been filled with provisional estimates using a number of estimation procedures. By integrating and cross checking existing State, local, and Federal data bases, system-development costs have been kept at a minimum. The report describes the methods used to develop REDI. Also, data summaries are provided that demonstrate the differences in quantity and quality of waste products according to State and sector designations.

26308 **(PB—86-134996/XAB) Overview of the Resources for the Future Environmental Data Inventory: methods, sources, and preliminary results. Volume 2. Final report.** Gianessi, L.P.; Peskin, H.M. (Resources for the Future, Inc., Washington, DC (USA)). Sep 1984. 256p. NTIS, PC A12/MF A01.

The Resources for the Future Environmental Data Inventory (REDI) describes discharges of 17 pollutants to the Nation's waters from over 80,000 industrial, municipal, urban, and agricultural sources. The data are indexed in sufficient detail to permit aggregation by economic sector, State, county, and hydrologic unit.

Data gaps have been filled with provisional estimates using a number of estimation procedures. By integrating and crosschecking existing State, local, and Federal data bases, system-development costs have been kept at a minimum. Volume one describes the methods used to develop REDI. Also, data summaries are provided that demonstrate the differences in quantity and quality of waste products according to State and sector designations.

26309 **(PB—86-136520/XAB) Evaluation of methods for hazardous chemicals listed in appendix d to 40 cfr 122 (table 5). Report for May 1984-March 1985.** Cole, T.F.; Lucas, S.V.; Cooke, W.M. (Battelle Columbus Labs., OH (USA)). Dec 1985. 123p. NTIS, PC A06/MF A01.

Of 75 organic compounds listed in Appendix D to 40 CRF 122 (Table V), 24 compounds have not been previously shown amenable to existing EPA Methods for analysis in water and wastewater. The present work reports on 17 of those 24 compounds using 600 Methods with appropriate modification. The approach was to demonstrate performance in the areas: (1) chromatography - using fused-silica capillary columns, (2) extraction and concentration, and (3) cleanup. When attempts were successful, the integrated method was tested for accuracy and precision. A purge-and-trap approach was shown to have substantial problems with the volatile amines. An automated heated headspace/capillary column method worked poorly for monoalkyl amines. A specially prepared column packing was effective for all of the volatile amines. No method development was achieved for either ethanolamine or isopropanolamine.

26310 **(PB—86-140647/XAB) AT123D: analytical transient one-, two-, and three-dimensional simulation of waste transport in the aquifer system. Model.** Kinerson, R.; Pilotte, J. (Environmental Protection Agency, Washington, DC (USA). Office of Pesticides and Toxic Substances). 1985. vp. NTIS, PC A02/MF A01.

A generalized, analytical transient one-, two-, and/or three-dimensional model for use in estimating the transport of wastes in a groundwater aquifer system. It contains options for combinations of various types of wastes, source configurations, source releases, and aquifer dimensions. The mechanisms of transport included in the analysis are advection, hydrodynamic dispersion, adsorption, decay/degeneration, and waste losses in the atmosphere. Software Description: The program is written in the FORTRAN programming language for implementation on a Digital VAX 11/780 computer using the VMS 4.1 operating system.

26311 **(PB—86-140654/XAB) AT123D execution using the data-management supporting systems AT123DIN and AT123DOUT. Users guide (draft).** (General Software Corp., Landover, MD (USA)). 26 Dec 1984. 41p. NTIS, PC A03/MF A01.

Detailed procedures required to execute AT123D through the use of two data-management systems are presented. The report is intended to be a comprehensive guide for users who have no specialized computer knowledge. AT123D is a generalized analytical transient one-, two-, and/or three-dimensional computer model designed for estimating the rate of pollutant (radioactive, chemical, or thermal) transport/transformation in a groundwater system. In the search for closed-form solutions to the partial differential equations describing the groundwater flow and transport phenomena, the application of the Green's function is used to its optimum advantage. As a result, the model has many optional capabilities and accepts a variety of source release patterns and configurations.

26312 **(PNL—5804) Model and assessment of the contribution of dredged material disposal to sea-surface contamination in Puget Sound.** Hardy, J.T.; Cowan, C.E. (Pacific Northwest Labs., Richland, WA (USA)). Feb 1986. Contract AC06-76RL01830. 43p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86007972.

Hydrophobic or floatable materials released to the water column during dredge disposal operations may accumulate in high concentrations on the water surface. If such surface accumulations occur, they could impact the reproduction of fish and shellfish with neustonic (floating) eggs or larvae. Also, floatable surface contaminants could deposit on nearby beaches. In order to examine the potential impacts of such processes, an interactive computer (IBM PC) model was developed. The FORTRAN model allows input of contaminant concentrations on the dredge material, the surface area of the disposal site, the floatable fraction of the contaminated material, and the baseline concentrations of contaminants present in the sea-surface microlayer. The model then computes the resultant concentrations of each contaminant in the microlayer and the potential impact on floating fish eggs. The utility of the model would be greatly improved by empirical data, not yeat available, on the vertical upward and lateral movement of contaminants during dredge material disposal.

26313 **(TVA/ONRED/AWR—85/11) Environmental implications of biomass conversion processes.** Lewis, A.R.; Bohac, C.E.; Lokey, J.D.; Malo, J.E. (Tennessee Valley Authority, Chattanooga (USA). Office of Natural Resources and Economic Development). Jul 1984. 64p. NTIS, PC A04/MF A01. File Number DE86901130.

The report presents environmental and pollution control system economic evaluations associated with processes to convert biomass to liquid and gaseous fuels. Direct combustion is also discussed. Thermochemical and biological conversion technologies investigated include gasification, pyrolysis, liquefaction, cellulosic hydrolysis, alcoholic fermentation, and anaerobic digestion. Also examined was the use of grain and wood for alcohol production, and combustion of wood in commercial and industrial boilers. Each process was reviewed from the standpoint of whether it would present an environmental risk to the TVA region should it be widely adopted. In addition to examining the impacts of individual plants, the cumulative impacts on the air and water resources of the Tennessee Valley of several commercial-scale alcohol plants were evaluated. The costs of advanced air and water cleanup systems which could potentially be required by regulators for alcohol production facilities were investigated to determine if they would significantly affect the economics of the conversion facilities. 30 refs., 11 figs., 5 tabs.

5203 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 25400, 25401, 25418, 25432, 25435, 25437, 26276, 26277, 26315

26314 **(PB—86-141959/XAB) Environmental Radiation Data, Report 41, January-March 1985.** Petko, C.M.; Phillips, C.R. (Environmental Protection Agency, Montgomery, AL (USA). Eastern Environmental Radiation Facility). Jun 1985. 36p. (EPA/520/5—85/030). NTIS, PC A03/MF A01.

Environmental Radiation Data (ERD) is compiled and distributed quarterly by the Office of Radiation Programs and contains data from the Environmental Radiation Ambient Monitoring System (ERAMS). Data from similar networks operated by contributing States, Canada, Mexico, and the Pan American Health Organization are reported in the ERD when available. The ERAMS is comprised of nationwide sampling stations that provide air, surface and drinking water, and milk samples from which environmental radiation levels are derived.

5205 Site Resource And Use Studies

REFER ALSO TO CITATION(S) 26280

26315 **(DPST—83-319-Rev.1) Georgia fishery study: implications for dose calculations. Revision 1.** Turcotte, M.D.S. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 5 Aug 1983. Contract AC09-76SR00001. 34p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86008041.

Fish consumption will contribute a major portion of the estimated individual and population doses from L-Reactor liquid releases and Cs-137 remobilization in Steel Creek. It is therefore important that the values for fish consumption used in dose calculations be as realistic as possible. Since publication of the L-Reactor Environmental Information Document (EID), data have become available on sport fishing in the Savannah River. These data pro-

vide SRP with a site-specific sport fish harvest and consumption values for use in dose calculations. The Georgia fishery data support the total population fish consumption and calculated dose reported in the EID. The data indicate, however, that both the EID average and maximum individual fish consumption have been underestimated, although each to a different degree. The average fish consumption value used in the EID is approximately 3% below the lower limit of the fish consumption range calculated using the Georgia data. Maximum fish consumption in the EID has been underestimated by approximately 60%, and doses to the maximum individual should also be recalculated. Future dose calculations should utilize an average adult fish consumption value of 11.3 kg/yr, and a maximum adult fish consumption value of 34 kg/yr. Consumption values for the teen and child age groups should be increased proportionally: (1) teen average = 8.5; maximum = 25.9 kg/yr; and (2) child average = 3.6; maximum = 11.2 kg/yr. 8 refs.

5206 Regulations

REFER ALSO TO CITATION(S) 26263, 26282

53 ENVIRONMENTAL-SOCIAL ASPECTS OF ENERGY TECHNOLOGIES

5301 Social And Economic Studies

REFER ALSO TO CITATION(S) 25429, 25707

26316 **(IVA—287) How much does a good environment cost. Possible calculation methods.** (Royal Swedish Academy of Engineering Sciences, Stockholm). 1985. 95p. (In Swedish). (CONF-850190—). NTIS (US Sales Only), PC A05/MF A01. File Number DE86751530.

From Conference on how much does a good environment cost; Stockholm, Sweden (9 Jan 1985).

The aim of this symposium was to improve the interdisciplinary cooperation in the fields of science and economy concerning environmental aspects. Special interest was paid to the interpretation of cost-benefit analysis as well as methodological problems in the different scientific fields. The symposium was directed to the decision-makers of the industry, the government and the local governments.

26317 (Juel-Spez—328, pp 79-89) **Interference from outside - problems and difficulties of co-operation on development.** Schuerings, H. (Frankfurt Univ., Germany, F.R.). Aug 1985. (In German). NTIS (US Sales Only), PC A11/MF A01. File Number DE86751624. (CONF-8505259—).

From Seminar on the use of small-scale wind energy plants in developing countries; Goeppingen, F.R. Germany (14 May 1985).

Examples are used to study the kind of problems and difficulties that arise in development work, especially from the social background, and which can occur when seeking or implementing new programmes and projects in a developing country. They also determine what strategies have to be applied in finding and implementing projects. The remarks are based on the author's many years of involvement in various development projects in Central Africa. (BR).

26318 **(NP—6751567) Senegal and the villages. A study on rural integration of electrification.** Melasuo, T.; Linden, M. (IVO Consulting Engineers Ltd., Helsinki (Finland)). 1985. 287p. (In Finnish). NTIS (US Sales Only), PC A13/MF A01. File Number DE86751567.

This study concerns nine Senegalese villages being dispersed in the central parts of the country. The electrification plans prepared for all these nine villages have recently been completed and at least some of the villages will be electrified in the near future. Aim of this study is to find out how the electrification and electricity will integrate into the social and economic structure of the villages, in other words, what the effects of electrification will be. The main object is to produce knowledge of how the electrification could be of greatest benefit for these villages. The ways of integration of electricity are determined by the global development of each village. That is why this research tries to pay attention to the global development with special focus on the production sector. The social and economic structures of the villages are studied mainly based on three sectors: production, public and private households. Electrification of these nine villages creates some inequality between them and the neighbouring non-electrified villages. The socio-economic importance of the electrification of these villages will increase, if they are not going to stay isolated exceptions instead of being part of a larger and wider rural electrification programme on national or regional level.

5302 Assessment Of Energy Technologies

REFER ALSO TO CITATION(S) 26257, 26277

5303 Environmental Impact Statements

REFER ALSO TO CITATION(S) 25308, 25309, 25429, 25534, 25535, 26276

55 BIOMEDICAL SCIENCES, BASIC STUDIES

5502 Biochemistry

REFER ALSO TO CITATION(S) 26183, 26325

26319 **(DOE/ER/12095—T1) Regulation of alcohol fermentation by Escherichia coli.** Clark, D.P. (Southern Illinois Univ., Carbondale (USA). Dept. of Microbiology). Mar 1986. Contract AC02-82ER12095. 6p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86009055.

The purpose of this project is to elucidate the way in which the fermentative synthesis of ethanol is regulated in the facultative anaerobe Escherichia coli. Focus is on the two final steps in alcohol synthesis, which are catalyzed by alcohol dehydrogenase and acetaldehyde CoA dehydrogenase. We have isolated a series of mutations affecting the expression of these enzymes. Some of these mutations are in the structural genes for these enzymes; others affect the regulation of the adh operon. We have recently cloned the genes coding for these enzymes and are now studying the effect of multiple copies of the adh gene on fermentative growth and its regulation. A recently invented technique, proton suicide has allowed the selection of a variety of novel mutants affecting fermentation which are presently being characterized. We have isolated a comprehensive collection of operon fusions in which the lacZ structural gene is fused to promoters that are inactive aerobically but active anaerobically. Although these genes (like adh) are only expressed under anaerobic conditions, the level of induction varies from two-fold to nearly 100-fold. The nitrogen source, medium pH, nature of the buffer, presence of alternative electron acceptors (e.g., nitrate), and other factors exert a great effect on the expression of many of these genes. In the near future we will investigate control mechanisms common to the adh operon and other anaerobically regulated genes.

5503 Cytology

26320 **(DOE/PC/20094—T1) [Mutagenicity testing for RCRA of residuals produced in the conversion of coal]. Final report.** (Pittsburgh Univ., PA (USA)). [1986]. Contract AC22-79PC20094. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86008303.

Because of the scarcity of fetal bovine serum (FBS), it was necessary to "wean" our CHO cells to a mixture of FBS and the more readily available newborn bovine serum (NBS). Our preliminary kinetic studies indicated a possible difference in cell cycle phases between CHO cells grown in FBS supplemented media relative to those in FBS + NBS. 2 figs.

5504 Genetics

REFER ALSO TO CITATION(S) 26330

26321 Complementation of an Escherichia coli pyrF mutant with DNA from Desulfovibrio vulgaris. Li, C.; Peck, H.D. Jr.; Przybyla, A.E. (Univ. of Georgia, Athens). *Journal of Bacteriology;* **165**: No. 2, 644-646(Feb 1986).

A PyrF$^-$ mutant of Escherichia coli (SK1108, pyrF::Tn5 Kan/sup r/) was complemented with the Desulfovibrio vulgaris (Hildenborough) structural gene for orotidine-5'-phosphate decarboxylase. Either orientation of a 1.6-kilobase-pair D. vulgaris DNA fragment (pLP3B or pLP3A) complemented the PyrF$^-$ strain suggesting that the D. vulgaris pyrF promoter was functional. The apparent product of the D. vulgaris pyrF gene was a single 26-kilodalton polypeptide. These results demonstrate the utility of E. coli cloning systems in studying metabolic and energetic pathways in sulfate-reducing bacteria.

5505 Metabolism

26322 (AD-A—162625/8/XAB) In vivo distribution of C^{14} radiolabeled soman ((3,3-dimethyl-2-butoxy)-methylphosphorylfluoride) in the central nervous system of the rat. (Army Medical Research Inst. of Chemical Defense, Aberdeen Proving Ground, MD (USA)). 1985. 9p. NTIS, PC A02/MF A01.

Radiolabeled ^{14}C soman, a potent anticholinesterase, was administered to rats at a dose of 0.75 LD50 (17.3 micrograms/kg, i.m.). Prior to being quick frozen, the animals were held for 2 min, 32 min or 48 h after dosing. Analysis of autoradiographs taken from cryostat sections through the central nervous system (CNS) showed that at 2 and 32 min radiolabel was primarily distributed in the blood, the choroid plexus and the cerebrospinal fluid (CSF), with several brain nuclei showing small increases in labeling density. At 48 h there was marked accumulation of radiolabel in the caudate and accumbens nuclei compared to all other brain areas. The above results showed little similarity between cholinesterase localization and distribution of radiolabel.

26323 (PB—86-111564/XAB) Rapid aquatic toxicity assay utilizing labeled thymidine incorporation in sea urchin embryos. Jackim, E.; Nacci, D. (Environmental Protection Agency, Narragansett, RI (USA). Environmental Research Lab.). 1984. 8p. (ERLN—605). NTIS, PC A02/MF A01.

Aquatic toxicity was evaluated in the sea urchin embryo (Arbacea punctulata) by the inhibition of tritiated thymidine incorporation after a brief exposure to toxic chemicals. Arbacia is a useful surrogate species for assay: well-studied, easily cultured and fertile virtually year round. The simplicity and speed of this test system lends itself to screening large numbers of compounds, mixtures or water samples.

5506 Medicine

26324 (IAEA-TECDOC—339, pp 63-74) **Studies on epitopic and idiotypic regulation in schistosomiasis: the use of monoclonal antibodies in radio-immuno- and avidin-biotin-enzyme assays.** Phillips, S.M.; Fox, E.G.; Fathelbab, M.N.; Walker, D.J.; Zodda, D.M. (Allergy and Immunology Section, Dept. of Medicine, Pennsylvania Univ., Philadelphia, USA). Jul 1985. NTIS (US Sales Only), PC A06/MF A01. File Number DE86701390. (CONF-8405377—).

From Advisory group meeting on immunodiagnosis of parasitic infections using nuclear techniques; Vienna, Austria (7 May 1984).

A series of monoclonal antibodies (MAbs) of both protective and non-protective nature against schistosomiasis mansoni have been produced in our laboratory. We attempted to identify and purify the specific antigen which was recognized by the protective MAb in hopes of obtaining a putative protective immunogen. Initial attempts at identification using crude ^{125}I-soluble cercarial immunogen in radioimmunoprecipitation protocols produced similar molecular weight banding patterns for all MAbs tested. Discrimination on the basis of antibody affinity also proved unrewarding as did isotype analysis; affinity of the protective MAb was not distinctive and all MAbs used in these assays were IgGl. Purifications of the crude antigen by affinity chromatography, using either protective or non-protective MAbs, produced bands that remained immunologically reactive as assayed by overlay analysis with ^{125}I-MAb, but again of identical molecular weight. We thus developed an avidin-biotin-HRP immunoassay to test for epitopic competition. Competition assays using biotinylated antisera or MAb demonstrated that the protective MAb was recognizing a distinct epitope on the antigen. It appears that the non-protective MAbs are cross-reactive for a second epitope. Other experiments demonstrated that binding of MAb could be blocked by addition of soluble antigen, and that anti-idiotypic antisera raised against the protective MAb cell lines would specifically inhibit binding of the inducing idiotypic MAb. Thus, we have demonstrated the utility of this method for assessing the basic components - epitope, idiotype and paratope directed anti-idiotype - of the idiotypic network as it pertains to schistosomiasis. 21 refs, 7 figs.

26325 (IAEA-TECDOC—339, pp 103-110) **Immunodiagnosis of filariasis, schistosomiasis and malaria. Summary of research carried out under the auspices of the UNDP/World Bank/WHO Special Programme for Research and Training in Tropical Diseases.** Houba, V.; Mott, K.E.; Martinez, L.J. (World Health Organization, Geneva, Switzerland). Jul 1985. NTIS (US Sales Only), PC A06/MF A01. File Number DE86701390. (CONF-8405377—).

From Advisory group meeting on immunodiagnosis of parasitic infections using nuclear techniques; Vienna, Austria (7 May 1984).

Results are reported from studies on the immunodiagnosis of filariasis, schistosomiasis and malaria which have been carried out under the auspices of the UNDP/World Bank/WHO Special Programme for Research and Training in Tropical Diseases. These studies include an evaluation of the RIPEGA and IRMA for the detection of filarial antigens; the selection and standardization of schistosome antigens for diagnostic purposes; and the development of tests for the detection of malaria antigens and antibodies. 20 refs.

26326 (PB—86-140944/XAB) Radiation experience data (RED) - documentation and results of the 1980 survey of US hospitals. Bunge, R.E.; Herman, C.L. (Food and Drug Administration, Rockville, MD (USA). Center for Devices and Radiological Health). Sep 1985. 104p. (HHS/PUB/FDA—86-8253). NTIS, PC A06/MF A01.

In 1980, the Center for Devices and Radiological Health of the PHS conducted a survey of the numbers and types of diagnostic radiologic examinations performed in a sample of 81 general, short-stay US hospitals. Data include information on patient age and sex for all conventional x-ray, computed tomography, nuclear medicine, and ultrasound procedures. This report discusses the planning and implementation of this survey and presents detailed results as well as comparisons to PHS x-ray surveys in 1964 and 1970. Major observations include an estimate of 130 million conventional x-ray procedures in hospitals. This is an increase of 59% since 1970 with the greatest increase in x-ray rates occurring in the 65-and-over age group.

5507 Microbiology

REFER ALSO TO CITATION(S) 26319

26327 (AD-A—163073/0/XAB) Photoreactivation of ultraviolet-irradiated, plasmid-bearing and plasmid-free strains of bacillus anthracis. Knudson, G.B. (Army Medical Research Inst. of Infectious Diseases, Fort Detrick, MD (USA)). 19 Dec 1985. 25p. NTIS, PC A02/MF A01.

The effects of toxin- and capsule-encoding plasmids on the kinetics of UV inactivation of various strains of Bacillus anthracis were investigated. Plasmids pX01 and pX02 had no effect on bacterial UV sensitivity or photoreactivation. Vegetative cells were capable of photoreactivation, but photo-induced repair of UV damage absent in B. anthracis Sterne spores.

26328 (DOE/ER/13160—3) Characterization of the heterokaryotic and vegetative diploid phases of Magnaporthe grisea. Crawford, M.S.; Chumley, F.G.; Weaver, C.G.; Valent, B. (Colorado Univ., Boulder (USA). Dept. of Chemistry). 1984. Contract AC02-84ER13160. 44p. NTIS, PC A03/MF A01; GPO Dep. File Number DE86008528.

The heterokaryotic and vegetative diploid phases of Magnaporthe grisea, a fungal pathogen of grasses, have been characterized. Hyphal tip cells and conidia (vegetative spores) taken from these heterokaryons are auxotrophs with phenotypes identical to one or the other of the parents. M. grisea heterokaryons have completely septate hyphae with a single nucleus per cell. Heterokaryons have been utilized for complementation and dominance testing of mutations that affect nutritional characteristics of the fungus. Heterokaryons growing on minimal medium spontaneously give rise to fast-growing sectors that have the genetic properties expected of unstable heterozygous diploids. In fast-growing sectors, most hyphal tip cells are unstable prototrophs. The conidia collected from fast-growing sectors include stable and unstable prototrophs, as well as auxotrophs that exhibit a wide range of phenotypes, including many recombinant classes. Genetic linkage in meiosis has been detected between two auxotrophic mutations that recombine in vegetatively growing unstable diploids. This suggests that homologous recombination occurs during vegetative growth of M. grisea. No interstain barriers to heterokaryosis and diploid formation have been detected. The mating type of the strains that are paired does not influence the formation of heterokaryons or diploids.

5509 Pathology

REFER ALSO TO CITATION(S) 26215, 26354, 26357

26329 (KFK-PEF—2, pp 69-79) Fluorescence and electron microscopy studies on the involvement of mycoplasmas, rickettsias and viruses in forest dieback. Methods of investigation and first results. Schulz, A.; Behnke, H.D. (Heidelberg Univ., Germany, F.R.). Apr 1985. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86751479. (CONF-8503225—).

From 1. status colloquium of the European Research Center project for air pollution abatement measures (PEF) of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (5 Mar 1985).

The phloem of beech, fir and spruce is studied with the aim to detect in situ mycoplasma-like and rickettsia-like organisms (MLO/RLO) as well as viruses. These could be spread further in the pathways of the transport tissues following infection via phloem-sucking or root-parasitizing vectors. Season-dependent migration within the tree (as known for MLOs) may be detected by monthly fixation and by sampling roots, trunk and branches. The sample group comprises trees exhibiting different degrees of damage (damage classes 0-3). The silver firs on which studies concentrated so far, revealed degenerations and necroses in the branch phloem of severely damaged trees. So far, no indications were found for any systemic spreading of the pathogens mentioned in either fluorescence-microscopic or electron-microscopic preparations.

5520 Public Health

REFER ALSO TO CITATION(S) 26181, 26187, 26188, 26189, 26190, 26191, 26192, 26193, 26194, 26195, 26196, 26197, 26198, 26199, 26200, 26201, 26202, 26203, 26205, 26206, 26207, 26208, 26210, 26212, 26213, 26214, 26216, 26217, 26218, 26219, 26220, 26221, 26222, 26223, 26227, 26228, 26229, 26230

5530 Agriculture And Food Technology

REFER ALSO TO CITATION(S) 25457, 25947, 26268

26330 (DOE/ER/13160—2) Genetic studies of fertility and pathogenicity in Magnaporthe grisea (Pyricularia oryzae). Valent, B.; Crawford, M.S.; Weaver, C.G.; Chumley, F.G. (Colorado Univ., Boulder (USA). Dept. of Chemistry). 1984. Contract AC02-84ER13160. 48p. NTIS, PC A03. File Number DE86008527.

Crosses between field isolates of Magnaporthe grisea (anamorph, Pyricularia oryzae Cav. and Pyricularia grisea) have led to the development of fertile laboratory strains that infect goosegrass and/or weeping lovegrass. These strains may now be utilized in a rigorous genetic analysis of host species specificity and general pathogenicity. Attempts to improve the fertility of rice pathogens for the goal of undertaking a genetic analysis of host cultivar specificity have so far been unsuccessful. Crosses between M. grisea strains that infect rice, goosegrass or weeping lovegrass demonstrate that host species specificity differences between field isolates of this fungus in some cases have a complete genetic basis, and in other cases have a simple genetic basis. Crosses between a field isolate of the pathogen that infects weeping lovegrass and a field isolate that infects goosegrass have resulted in the identification of a single gene difference that determines pathogenicity toward weeping lovegrass and a second unlinked single gene difference that determines pathogenicity toward goosegrass. 35 refs., 4 figs., 3 tabs.

26331 (TVA/OACD—85/10) 1984 Fertilizer summary data. Hargett, N.L.; Berry, J.T. (Tennessee Valley Authority, Muscle Shoals, AL (USA). Office of Agricultural and Chemical Development). Jun 1985. 134p. NTIS, PC A07/MF A01. File Number DE86901146.

"Fertilizer Summary Data" is published every two years as part of TVA's fertilizer research, development, and education program. It brings together historical fertilizer use and crop statistics, application rates, and farm income and expense data for use in production planning and market evaluation. This edition summarizes US consumption (including Puerto Rico) of fertilizer and plant nutrients through the year ended June 30, 1984. It also includes TVA distribution of fertilizer materials in the industry demonstration program for 1981 through 1984. The summaries are presented for regions of USA.

56 BIOMEDICAL SCIENCES, APPLIED STUDIES

REFER ALSO TO CITATION(S) 26271

5601 Radiation Effects

REFER ALSO TO CITATION(S) 26612

26332 (CONF-860146—7) Developing a flexible and verifiable integrated dose assessment capability. Parzyck, D.C.; Rhea, T.A.; Copenhaver, E.D.; Bogard, J.S. (Oak Ridge National Lab., TN (USA)). 1986. Contract AC05-84OR21400. 13p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86007854.

From Radiobioassay and internal dosimetry workshop; Albuquerque, NM, USA (20 Jan 1986).

Due to the ever-changing regulatory environment there is a need for a flexible yet verifiable system of computing and recording personnel doses. Recent directions in Chapter XI requirements, dictated by earlier advances forwarded by ICRP 26, establish the trend of combining internal and external doses. We are currently developing a Health Physics Information Management System (HPIMS) which will: (1) centralize dosimetry calculations and data

storage; (2) integrate health physics records with other health-related disciplines, such as industrial hygiene, medical, and safety; (3) provide a more auditable system with published algorithms and clearly defined flowcharts of system operation; (4) readily facilitate future changes dictated by new regulations, new dosimetric models, and new systems of units (such as recommended by the recent NCRP report 82 on SI units); and (5) address ad-hoc inquiries regarding worker-workplace interactions, including potential synergisms with non-radiation exposures.

26333 (ENEA-RT/STUDI—84-1) **Quantitative risk assessment of ionizing radiation. Lessons from chemical carcinogens.** Martinelli, M.; Ricci, P.F. (ENEA, Casaccia (Italy). Direzione Centrale Studi - Unita Valutazioni Ambientali; Electric Power Research Inst., Palo Alto, CA (USA)). 1983. 14p. (IAEA-SM—266/77; CONF-830450—4). NTIS (US Sales Only), PC A02/MF A01. File Number DE86900962.

From IAEA/WHO symposium on biological effects of low level radiation; Venice, Italy (11 Apr 1983).

This paper contains a synthesis of the information required to understand the mechanisms of dose-response commonly found in health risk analysis. The focus is on carcinogenesis from chemicals and ionizing radiations. There are two sections: the stochastic functions of carcinogenesis, and the role of animal study and epidemiology in producing the parameters of these functions. The emphasis is on how long-term experimental results in animals and epidemiological studies are used to determine the carcinogenic potencies of pollutants at the low doses normally encountered in the environment or in the workplace. The key conclusion is that (although there is much uncertainty that must be resolved) some of the necessary knowledge now exists to make judgements about the usefulness of dose-response models of cancers from environmental pollution, but if and only if the associated uncertainty is included in the results of the analysis. 21 refs.

26334 (GSF—25/85) **Statistical results of official personnel dose monitoring 1984. Dosemeter records office.** Drexler, G.; Eckerl, H.; Haid, G.; Scheibe, D. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.)). Jul 1985. 43p. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number DE86751108.

The report consists of a summary of relevant statistical data from the official personnel dosimetry in 1984. Under survey were occupationally exposed persons in the states of Bavaria, Hessen and Schleswig-Holstein. The data are based on the survey of more than 6,500 institutions with nearly 75,000 persons and are derived from approx. 900,000 single measurements. The report covers informations on the institutions, on the persons as well as dosimetric values. The measuring method is described briefly with respect to dosimeters used, their range and the interpretation of values. Information on notional doses and the interpolation of values nearby the detection limits are given. (orig.).

26335 (GSF—37/85, pp vp) **Model of UV-induced mutagenesis in Saccharomyces cerevisiae.** Siede, W.; Eckardt, F. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg, Germany, F.R. Abt. fuer Strahlenbiologie). 1985. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number DE86751457. (CONF-8510290—Absts.).

From 9. meeting of the Gesellschaft fuer Umwelt-Mutationsforschung e.V.: somatic mutations and cancer; Neuherberg, F.R. Germany (16 Oct 1985).

26336 (IAEA-TECDOC—349, pp 81-85) **Implementation of food irradiation in France. Involvement of public institutions.** Henon, Y. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-les-Durance, France). Oct 1985. NTIS (US Sales Only), PC A06/MF A01. File Number DE86701384. (CONF-8411235—).

From FAO/IAEA advisory group meeting on regulatory and technological requirements for authorization of the food irradiation process; Vienna, Austria (5 Nov 1984).

In France irradiation has become one of the main issues of the food industry for about two years. Though the development and use of this process will lie in the hands of private companies, public institutions have a paramount role, especially in the early stages, at four different levels: basic research, clearances, industrial development, information.

26337 (IAEA-TECDOC—349, pp 52-63) **Licensing of food irradiation facilities.** Cornelis, J.C. (Ministerie van Volksgezondheid en Milieuhygiene, Rijkswik, Netherlands). Oct 1985. NTIS (US Sales Only), PC A06/MF A01. File Number DE86701384. (CONF-8411235—).

From FAO/IAEA advisory group meeting on regulatory and technological requirements for authorization of the food irradiation process; Vienna, Austria (5 Nov 1984).

In licensing a food-irradiation facility two sets of requirements should be dealt with. The facility uses a big radiation source for the purpose of treating food. It follows that the first set of requirements for a facility are the requirements of radiation protection and the second set of requirements have to do with the way food will be processed. This paper deals with the first set of requirements and the registration of a facility.

26338 (IAEA-TECDOC—349, pp 64-80) **Updating of the proposed model regulations for the control of and trade in irradiated foods.** Gerard, A. (Universite Libre de Bruxelles, Belgium). Oct 1985. NTIS (US Sales Only), PC A06/MF A01. File Number DE86701384. (CONF-8411235—).

From FAO/IAEA advisory group meeting on regulatory and technological requirements for authorization of the food irradiation process; Vienna, Austria (5 Nov 1984).

The Joint FAO/IAEA/WHO Expert Committee on the Wholesomeness of Irradiated Food convened in 1980 (JECFI) was able to formulate a general recommendation on the acceptability of food irradiated up to an overall average dose of 10 kGy. In view of the findings and recommendations of the latter JECFI the Recommended International General Standard for Irradiated Foods was amended, and adopted by the Codex Alimentarius Commission at its 15th session in 1983. The amended version entitled "Codex General Standard for Irradiated Foods" as well as the "Recommended International Code of Practice for the Operation of Irradiation Facilities used for the Treatment of Foods" have been published in the Codex Alimentarius Commission, Volume XV, in 1983, and distributed to all Member Nations and Associate Members of FAO and/or WHO in 1984. Since the proposed "Model Regulations" must comply with the present Codex General Standard for Irradiated Foods, it appears necessary to revise several provisions of the "Model Regulations". The revised text of the "Model Regulations for the Control of and Trade in Irradiated Foods" is presented.

26339 (IAEA-TECDOC—349, pp 86-92) **Legislation on food irradiation in Chile.** Rubio, T. (Comision Chilena de Energia Nuclear, Santiago). Oct 1985. NTIS (US Sales Only), PC A06/MF A01. File Number DE86701384. (CONF-8411235—).

From FAO/IAEA advisory group meeting on regulatory and technological requirements for authorization of the food irradiation process; Vienna, Austria (5 Nov 1984).

Chile accepts into its legislation the food irradiation if it is carried out in foods in which the doses were established by the Joint Expert Committee FAO/WHO/IAEA, Geneva, 1980. To carry out semi-commercial irradiations in foods there is a Multipurpose Pilot Plant which belongs to the CH.N.E.C. The Chilean legislation accepts the construction and the operations of food irradiation facilities which can be done after the authorization of the Ministry of Health.

26340 (IAEA-TECDOC—349, pp 93-103) **Codex General Standard for Irradiated Foods. Explanation of its purpose and scope.** Ladomery, L.G. (Food and Agricultural Organization of the United Nations, Rome, Italy. Joint FAO-WHO Food Standards Programme). Oct 1985. NTIS (US Sales Only), PC A06/MF A01. File Number DE86701384. (CONF-8411235—).

From FAO/IAEA advisory group meeting on regulatory and technological requirements for authorization of the food irradiation process; Vienna, Austria (5 Nov 1984).

The Codex General Standard for Irradiated Foods covers only those aspects which relate to the process of treating foods with ionizing radiation. Although the standard is intended to cover only those aspects which are thought to require regulatory control in connection with foods moving in trade, certain aspects relating to the irradiation facility have also been included which cannot, as yet, be checked on the food offered for sale.

26341 (IAEA-TECDOC—349, pp 104-107) **Codex General Standard for Irradiated Foods: Worldwide Standard.** Oct 1985. NTIS (US Sales Only), PC A06/MF A01. File Number DE86701384. (CONF-8411235—).

From FAO/IAEA advisory group meeting on regulatory and technological requirements for authorization of the food irradiation process; Vienna, Austria (5 Nov 1984).

This standard applies to foods processed by irradiation. It does not apply to foods exposed to doses imparted by measuring instruments used for inspection purposes.

26342 (IAEA-TECDOC—349, pp 108-118) **Recommended International Code of Practice for the operation of irradiation facilities used for the treatment of foods.** Oct 1985. NTIS (US Sales Only), PC A06/MF A01. File Number DE86701384. (CONF-8411235—).

From FAO/IAEA advisory group meeting on regulatory and technological requirements for authorization of the food irradiation process; Vienna, Austria (5 Nov 1984).

This code refers to the operation of irradiation facilities based on the use of either a radionuclide source (^{60}Co or ^{137}Cs) or X-rays and electrons generated from machine sources. The irradiation facility may be of two designs, either "continuous" or "batch" type. Control of the food irradiation process in all types of facility involves the use of accepted methods of measuring the absorbed radiation dose and of the monitoring of the physical parameters of the process. The operation of these facilities for the irradiation of food must comply with the Codex recommendations on food hygiene.

26343 **(PNL—5750-Pt.4) Pacific Northwest Laboratory annual report for 1985 to the DOE Office of Energy Research. Part 4. Physical sciences.** Toburen, L.H. (Pacific Northwest Labs., Richland, WA (USA)). Feb 1986. Contract AC06-76RL01830. 74p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE86008875.

Part 4 of the Pacific Northwest Laboratory Annual Report for 1985 to the DOE Office of Energy Research includes those programs funded under the title "Physical and Technological Research." The Field Task Program Studies reports in this document are grouped by budget category and each section is introduced by an abstract that indicates the Field Task Proposal/Agreement reported in that section. These reports only briefly indicate progress made during 1985. The reader should contact the principal investigators named or examine the publications cited for more details.

26344 **(PNL-SA—13663) Performance criteria for radiobioassay.** Heid, K.R.; MacLellan, J.A.; Traub, R.J. (Pacific Northwest Labs., Richland, WA (USA)). Dec 1985. Contract AC06-76RL01830. 8p. (CONF-860146—6). NTIS, PC A02/MF A01; GPO Dep. File Number DE86007736.

From Radiobioassay and internal dosimetry workshop; Albuquerque, NM, USA (20 Jan 1986).

The Bioassay Performance Criteria standard provides requirements for the accuracy, precision, and detection limits for measurements of selected radionuclides in the bodies of, or in biological samples from, persons occupationally exposed to the intake of radioactive materials. It also provides standard quality control procedures for the internal quality assurance programs of radiobioassay laboratories, and criteria to be used as a basis by testing laboratories to evaluate the conformance of radiobioassay service laboratories to both the quantitative performance criteria for accuracy, precision and detection limits, and standard quality control procedures.

26345 **(RFP—3935) Rocky Flats dose assessment practices.** Coldren, L.E.; Falk, R.B. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). 1986. Contract AC04-76DP03533. 7p. (CONF-860149—2). NTIS, PC A02. File Number DE86007964.

From DOE beta measurement workshop; Albuquerque, NM, USA (23 Jan 1986).

The assessment of dose for lung and systemic deposition is discussed for 1985 and earlier methodology. The methodology being developed to comply with the anticipated implementation by DOE of I.C.R.P.-30 requirements is also presented. 9 refs.

26346 **(UCRL—88131) Personnel neutron dosimetry.** Hankins, D. (Lawrence Livermore National Lab., CA (USA)). Apr 1982. Contract W-7405-ENG-48. 58p. (CONF-8204204—1). NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE86008140.

From Institute of Nuclear Power Operations conference; Houston, TX, USA (8 Apr 1982).

This edited transcript of a presentation on personnel neutron discusses the accuracy of present dosimetry practices, requirements, calibration, dosemeter types, quality factors, operational problems, and dosimetry for a criticality accident. 32 figs. (ACR)

26347 **Evidence for retrovirus in miniature swine with radiation-induced leukemia or metaplasia.** Frazier, M.E. (Pacific Northwest Labs., Richland, WA, USA). *Archives of Virology;* **83**: No. 1-2, 83-97(Jan 1985).

Biochemical and morphological evidence indicates that a type-C retrovirus is present in the blood of swine (both leukemic and nonleukemic) exposed to strontium-90 radiation. Nonexposed swine that were leukemic also had virus present. The virus was shown to contain an RNase-sensitive DNA polymerase activity with cation, detergent and template requirements similar to those of known viral reverse transcriptases. The buoyant density of the virus was 1.14 to 1.16 g/ml, whih can be converted, by treatment with ether, to a virion core having a density of 1.2 to 1.23 g/ml. Linear regression analysis indicated a correlation between virus-associated DNA polymerase activity and the number of blast cells in the peripheral blood. (Author).

5603 Chemicals Metabolism And Toxicology

REFER ALSO TO CITATION(S) 25291, 25291, 25327, 25328, 26160, 26162, 26168, 26175, 26176, 26343

26348 **(AD-A—162727/2/XAB) Development and use of anucleated bacterial cells to assay the in vivo activity of pollutants. Final report, April 1981-July 1985.** Reeve, J.N.; Rice, J.B. (Ohio State Univ., Columbus (USA). Dept. of Microbiology). 31 Jul 1985. 93p. NTIS, PC A05/MF A01.

There were 2 objectives in this research project: development of an in vivo assay for mistranslation-inducing activity of pollutants and characterization of amino acid substitutions. The first objective proved to be the more difficult. The T7 0.3 gene product (0.3 protein) was purified by a modification of the published procedure, and used to raise rabbit antibody to this protein. A radioimmune precipitation assay was developed which could be used to estimate increased misincorporation of cysteine into 0.3 protein. A sample assay involving only counting of the radioimmune precipitate was not achieved because we were not able to obtain the 0.3 protein free of contaminating proteins in the RIP. The 2nd objective proved more fruitful. The authors were able to successfully identify the cysteine substitution sites in the N-terminal 42 positions of 0.3 protein. Cleavage of 0.3 protein with trypsion to identify cysteine for arginine substitutions showed that the major sites of cysteine misincorporation were at residues other than arginine. Sequencing of ^{35}S cysteine-labeled 0.3 protein showed that the most frequent substitution was at residue 15 (tyrosine) and other substitutions were at a positions 9 (asparagine), 12 (aspartate), 41 (alanine) and 42 (aspartqate). Mistakes at these positions were unexpected and show that context greatly affects misincorporation and that misreading of 2 bases in the triplet at a time occurs relatively frequently.

26349 (CONF-851050—1) Carbon-nutrient interactions in response to CO_2 enrichment: physiological and long-term perspectives. Norby, R.J.; Pastor, J.; Melillo, J.M. (Oak Ridge National Lab., TN (USA); Minnesota Univ., Duluth (USA). Natural Resources Research Inst.; Marine Biological Lab., Woods Hole, MA (USA). Ecosystems Center). 1985. Contract AC05-84OR21400. 23p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86007919.

From International symposium on whole-plant physiology: coupling of carbon, water, and nutrient interactions in woody plant soil systems; Knoxville, TN, USA (6 Oct 1985).

The responses of forest trees to atmospheric CO_2 enrichment will depend in part on carbon-nutrient linkages. Insights into the possible long-term ecological consequences of CO_2 enrichment can be gained from studying physiological responses in short-term experiments. One-year-old white oak (Quercus alba L.) seedlings were grown in an unfertilized forest soil for 40 weeks in controlled-environment chambers with ambient (362 $\mu L.L^{-1}$) or elevated (690 $\mu L.L^{-1}$) CO_2. Seedling dry weight was 85% greater in the elevated CO_2 environment, despite a severe nitrogen deficiency in all seedlings. The increase in growth occurred without a concomitant increase in nitrogen uptake, indicating an increase in nitrogen-use efficiency in elevated CO_2. The weight of new buds was greater in elevated CO_2, suggesting that shoot growth in the next year would have been enhanced relative to that of seedlings in ambient CO_2. However, there was a lower amount of translocatable nitrogen in perennial woody tissue in elevated CO_2; thus, further increases in nitrogen-use efficiency may not be possible. The leaves that abscised from seedlings in elevated CO_2 contained higher amounts of soluble sugars and tannin and a lower amount of lignin compared with amounts in abscised leaves in ambient CO_2. Based on lignin to N and lignin to P ratios, the rates of litter decomposition might not be greatly affected by CO_2 enrichment, but the total amount of nitrogen returned to soil would be lower in elevated CO_2.

26350 (DFVLR-FB—85-49) Investigation of information content of Thematic Mapper and SPOT Multiband image data using simulated image data of the Freiburg region. Kirchhof, W.; Mauser, W.; Stiebig, H.J. (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt e.V., Koeln (Germany, F.R.)). 1985. 141p. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE86751461.

Data sets with pixel sizes of 10, 20, 30, 50 and 80 m created from data of a TM simulation in the Freiburg region, gathered on July 21, 1983, were used for a comparative analysis of information contents. The discrimination of objects, structures and texture, depending on pixel size and combination of spectral bands, was investigated by visual interpretation and supervised classification for applications in agriculture and forestry. The new TM bands brought strong improvements in the separation of vegetated and built-up areas as well as in the delineation of the status of growth and humidity in comparison with Landsat MSS. The Thematic Mapper is eminently suited for the extraction of thematic information of surface areas of 1 hectar or more. Three to four spectral bands are normally sufficient. The information content of 20-m SPOT multiband data does not differ essentially from that of comparable TM bands (TM2, TM3, TM4). A substantial complement to the TM information are structure and texture elements of the panchromatic 10-m SPOT band. With 37 figs., 42 tabs., 28 refs.

26351 (GSF—37/85) Somatic mutations and cancer. Abstracts. (Gesellsachft fuer Strahlen- und Umweltforschung m.b.H., Muenchen, Neuherberg (Germany, F.R.). Abt. fuer Toxikologie). 1985. 45p. (In German). (CONF-8510290—Absts.). NTIS (US Sales Only), PC A03/MF A01. File Number DE86751457.

From 9. meeting of the Gesellschaft fuer Umwelt-Mutationsforschung e.V.: somatic mutations and cancer; Neuherberg, F.R. Germany (16 Oct 1985).

This book of abstracts of 28 lectures summarizes experiments on the detection and characterisation of mutations of the gonadal cells in mice. Separate records are available for 3 of the lectures.

26352 (GSF—37/85, pp vp) Contributions to the discussion on mutagenicity and carcinogenesis of formaldehyde. Basler, A. (Bundesgesundheitsamt, Berlin, Germany, F.R.). 1985. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number DE86751457. (CONF-8510290—Absts.).

From 9. meeting of the Gesellschaft fuer Umwelt-Mutationsforschung e.V.: somatic mutations and cancer; Neuherberg, F.R. Germany (16 Oct 1985).

26353 (GSF—37/85, pp vp) Genotoxic damage due to airborne dusts in the atmosphere: Increase of malignant cell transformation, induction of punctial mutations, and of sister chromatid exchange. Seemayer, N.H.; Manojlovic, N.; Koenig, H. (Duesseldorf Univ., Germany, F.R. Medizinisches Inst. fuer Umwelthygiene). 1985. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number DE86751457. (CONF-8510290—Absts.).

From 9. meeting of the Gesellschaft fuer Umwelt-Mutationsforschung e.V.: somatic mutations and cancer; Neuherberg, F.R. Germany (16 Oct 1985).

26354 (KFK-PEF—2, pp 43-47) Anatomical and histochemical studies for clarifying the possible involvement of biotic pathogens in forest dieback. Braun, H.J.; Fink, S. (Freiburg Univ., Germany, F.R. Inst. fuer Forstbotanik und Holzbiologie). Apr 1985. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86751479. (CONF-8503225—).

From 1. status colloquium of the European Research Center project for air pollution abatement measures (PEF) of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (5 Mar 1985).

The issue of a possible involvement of biotic pathogens (viruses, viroids, MLO, RLB) in forest dieback was approached at 3 levels: 1) tests for direct detection and identification of pathogens in section and immersion preparations using electron microscopy. 2) Histological and histochemical tests of tissues taken from healthy and diseased trees to find direct indications of biotic pathogens, if possible (through structural changes or physiological reactions). 3) Tests for transmission and regeneration involving affected tree species and herbaceous test plants. Results gained so far suggest viruses to possibly participate in the syndrome of forest dieback; however, they furnish no clear-cut proof yet.

26355 (KFK-PEF—2, pp 49-68) Studies on the hormone balance of healthy and forest-dieback-affected conifers. Frenzel, B. (Hohenheim Univ., Stuttgart, Germany, F.R. Inst. fuer Botanik). Apr 1985. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86751479. (CONF-8503225—).

From 1. status colloquium of the European Research Center project for air pollution abatement measures (PEF) of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (5 Mar 1985).

The study on hand focussed on establishing safe criteria for the detection of actually healthy conifers. The comprehensive test series revealed that the annual ring analysis performed on a large sample group is the safest and most easily handled method and that analysis of stable-isotope incorporation into the cellulose of the wood is extremely accurate but rather painstaking and costly. Using a large sample group, an analysis of net assimilation and transpiration under standardized external conditions but at fluctuating water saturation deficits of the test air will allow identification of trees that healthy or latently diseased. Using material comparable in terms of physiology and ecology, registration of the ultrastructures of the chloroplasts, mitochondria, and dictyosomes of young needles and spring parenchymas will allow, determination about one year in advance whether or not the disease will become manifest in the tree concerned. To date, osmotic values, starch and glycosyl contents, and presumably the water contents of young needles and of the phloem along the trunk axis are not criteria indicating the tree's state of health. Analyses of an inert final product of ethylene synthesis, i.e. N-malonyl-1-aminocyclopropane-1-carboxylic acid, apparently allows some good insight into the stress loads undergone

several years prior to the tests in as much as these loads find their expression in ethylene synthesis.

26356 (KFK-PEF—2, pp 81-105) **Investigations on the functioning of the photosynthetic apparatus in needles of healthy and affected conifers.** Lichtenthaler, H.K.; Schmuck, G.; Doell, M.; Buschmann, C. (Karlsruhe Univ., T.H., Germany, F.R. Botanisches Inst. 1). Apr 1985. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86751479. (CONF-8503225—).

From 1. status colloquium of the European Research Center project for air pollution abatement measures (PEF) of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (5 Mar 1985).

In extended test analyses in 1984 it was demonstrated in fir (Abies alba) and spruce (Picea abies) that the rate of photosynthesis of green and yellowgreen needles of affected trees in general is significantly lower than that of fully green healthy trees. Furthermore, the needles of affected trees exhibit greatly altered ratios for the photosynthetic pigments. There are some indications that the regulation of stomata and the water balance are also affected in the needles of sick trees. A combination of pigment analyses, chlorophyll fluorescence kinetics and CO_2/H_2O-porometer-measurements permits an efficient early diagnosis of needle damage before the yellowing of needles becomes visible.

26357 (KFK-PEF—2, pp 107-115) **Effects of pollutants on the conformation of chlorophyll-protein complexes in air-pollution-damaged trees. Pt. 1. Systematic studies on the isolation of chlorophyll proteins from one-year-old and two-year-old needles of fir and spruce of damage class 0.** Siefermann-Harms, D.; Ninnemann, H. (Tuebingen Univ., Germany, F.R. Inst. fuer Chemische Pflanzenphysiologie). Apr 1985. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86751479. (CONF-8503225—).

From 1. status colloquium of the European Research Center project for air pollution abatement measures (PEF) of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (5 Mar 1985).

Damaging environmental impacts on conifers which will finally result in chlorophyll dislocation or fading, may be detected at an early stage by structural changes of the chlorophyll proteins of the photosynthesis apparatus. Part I of this project deals with techniques for gently isolating these proteins from the needles of healthy firs (Abies alba) and spruces (Picea abies). These techniques are meant for use in the comparative study of healthy and air-pollution-damaged conifers of the 'Kaelbelescheuer' stand, Southern Black Forest, during the 1985 vegetation period. One method for isolating chloroplasts from fully developed needles was elaborated. These isolated chloroplasts are resistant to osmotic shock thus remaining stable, and cannot be solubilized by conventional techniques. Under modified solubilization conditions, we obtain chlorophyll proteins (light collection complex, complexes of the photosystems I and II) from needles corresponding to those of one-year-old plants following iso-electric focussing.

26358 (KFK-PEF—2, pp 117-131) **Analysis of material changes in the leaves and needles of air-pollution-damaged forest trees.** Juettner, F. (Tuebingen Univ., Germany, F.R. Inst. fuer Chemische Pflanzenphysiologie). Apr 1985. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86751479. (CONF-8503225—).

From 1. status colloquium of the European Research Center project for air pollution abatement measures (PEF) of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (5 Mar 1985).

Using gas chromatographic and mass-spectrometric methods, a qualitative and quantitative study was made on the volatile substances (monoterpenes and sesquiterpenes, alkenones, alkenols, sulphur compounds, amines, phenols) of healthy and severely air-pollution-damaged spruces of the Kaelbelescheuer stand (Southern Black Forest). Whereas concentrations for most monoterpene hydrocarbons showed a marked drop in the needles of affected trees, the myrcene value rose by a factor of three. These values suggest major changes in terpene metabolism regulation owing to air pollution damage. Sesquiterpenes have increased rates in affected needles; the same applies for free acids and phenols. Monoterpenes and organic man-made pollutants occuring in the forest air were identified.

26359 (KFK-PEF—2, pp 133-144) **Lipid peroxidation: A phytotoxic consequence of air pollutants.** Kunert, K.J. (Konstanz Univ., Germany, F.R. Lehrstuhl fuer Physiologie und Biochemie der Pflanzen). Apr 1985. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86751479. (CONF-8503225—).

From 1. status colloquium of the European Research Center project for air pollution abatement measures (PEF) of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (5 Mar 1985).

In the presence of oxygen 'stress ethylene' is induced in plant cells by SO_2 in the light. When the extent of stress undergone by cells dramatically increases, peroxidation of polyunsaturated fatty acids in cells, measured as ethane or malondialdehyde production, becomes the dominant reaction. A phytotoxic consequence of lipid peroxidation is the destruction of cell components, such as chlorophyll. Antioxidants, like the vitamins E and C that act synergistically, inhibit cellular peroxidation induced by air pollutants.

26360 (KFK-PEF—2, pp 145-162) **Ozone as a possible causative agent of forest damage.** Arndt, U. (Hohenheim Univ., Stuttgart, Germany, F.R. Inst. fuer Landeskultur und Pflanzenoekologie). Apr 1985. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86751479. (CONF-8503225—).

From 1. status colloquium of the European Research Center project for air pollution abatement measures (PEF) of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (5 Mar 1985).

The hypothesis of ozone involvement in forest dieback was formulated and postulated for the first time in 1982; measurements performed in forest damage areas for its substantiation showed remarkably high ozone concentrations whose phytotoxic relevance cannot be refuted. Subsequent studies involving the bio-indicator plants of tobacco, bush bean and stinging nettle which were exposed in pots at corresponding sites, showed clear necroses in tobacco. These findings resulted in setting up an open-top chamber facility in Hohenheim in which young beech, fir and spruce trees were treated with ozone, SO_2 and acid precipitation. Following exposure to ozone, young spruce trees gave off markedly more Ca and Mg to simulated acid precipitation than they did without any corresponding pretreatment. In addition, a marked reduction of photosynthesis activity was measured in fir following ozone treatment. The results on hand are given in terms of orientational reference and require a more thorough-going study.

26361 (KFK-PEF—2, pp 229-235) **Changes in humus condition within the context of forest dieback with special reference to fertilization tests.** Babel, U. (Hohenheim Univ., Stuttgart, Germany, F.R. Inst. fuer Bodenkunde und Standortslehre). Apr 1985. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86751479. (CONF-8503225—).

From 1. status colloquium of the European Research Center project for air pollution abatement measures (PEF) of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (5 Mar 1985).

The activities listed in the working plan yielded a number of results since the beginning of their evaluation in May 1984 concerning humus profile changes from 1965 or 1972, resp., to 1984. Humus profiles were studied differentially at 10 areas (beech or spruce, resp., on humus ranging from mull to mould of slight thickness) in the Harthaeuser Wald near Neuenstadt a.K., out of which 5 were found to reveal minor changes which are unfavourable in terms of humus ecology and suggest a reduction of soil fauna activity. Slight unfavourable changes were found as well at two sites in the Baar-Schwarzwald (spruce on thick mould); no clearly negative changes were noted at two other sites of that area (fir and spruce on mull or mould of slight thickness, resp.) neither at one site (fir, spruce, mull) in the Upper Neckar forest area. A number of these areas will have to be studied for the extent to which the direct or indirect air pollution effects under study are superimposed by other changes in the eco-system. Activities were taken up at Mauzenberg

in the Northern Black Forest mountains to study the humus profile development of a forest stand severely affected by air pollution input.

26362 (KFK-PEF—2, pp 237-255) **Structure and function of forest ecosystems - zoological contributions in analyzing causality of forest damages - investigations into invertebrate coenoses.** Funke, W. (Ulm Univ., Germany, F.R. Abt. Oekologie und Morphologie der Tiere). Apr 1985. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86751479. (CONF-8503225—).

From 1. status colloquium of the European Research Center project for air pollution abatement measures (PEF) of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (5 Mar 1985).

On soil animals in the fluctuations of population density precisely observed between 1977 and 1984 in a spruce stand are well correlated with annual precipitation and mean annual temperatures. They were influenced, too, by competition for food (and, or space) and by other interrelations between or within populations. Litter decomposition, partly caused and regulated by detritophagous soil animals, also was influenced by climate conditions. This 'natural' attenuation of forests' vitality in some regions of Europe by more or less contaminations might be enhanced to the outstanding sickness and dying of trees, in the last years. Several groups of soil animals seem to be suitable indicators for estimation of forest damage, esp. caused by air and water pollutions. This may be concerned particularly in studying consumers of mycorrhiza. Most solid statements however are assumed to be obtained by determination of diversity of important members of animal community. Fertilization experiments yielded up to now rather considerable different results. Positive influences were observed after liming by rising of population densities, whereas an additional treatment using 5 $Ca(NO_3)_2$. NH_4NO_3 produced more negative effects. Artificial irrigations in addition to normal rainfall in cases when natural dryness of soil reaches a certain low degree generally yielded some positive effects on population densities and influenced increase of litter decomposition. In analysing some fluxes of elements within ecosystem basic data were gained studying plants, litter layer and newly emerged soil beetles. Some elements (esp. Zn and Cr) seem to be accumulated in beetles tissue.

26363 (KFK-PEF—2, pp 257-265) **Change in soil flora as an indicator of possible landscape-ecological effects of forest dieback.** Steinlin, H.J.; Buerger, R. (Freiburg Univ., Germany, F.R. Inst. fuer Landespflege). Apr 1985. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86751479. (CONF-8503225—).

From 1. status colloquium of the European Research Center project for air pollution abatement measures (PEF) of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (5 Mar 1985).

The research project is in the preparatory stage for practical field work during the 1985 vegetation period. Activities will cover a comprehensive initial phytosociological inventory of permanent observation areas located in representative forest stands of different site types and varying degrees of damage. Correspondingly preparations comprise clarification of the method approach to be adopted for the acquisition and further processing of site data, as well as collection, filing and summary mapping of information significant for final test-area selection. (orig./MG).

26364 (KFK-PEF—2, pp 413-424) **Influence of the surface structure of leaves and needles of forest trees on the content of sulfur and the deposition and uptake of metals.** Rentschler, I.; Schreiber, H. (Hohenheim Univ., Stuttgart, Germany, F.R. Inst. fuer Physik). Apr 1985. (In German). NTIS (US Sales Only), PC A99/MF A01. File Number DE86751479. (CONF-8503225—).

From 1. status colloquium of the European Research Center project for air pollution abatement measures (PEF) of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (5 Mar 1985).

Samples of needles from fir and spruce were investigated by electron microscopy and X-ray analysis. The scanning electron microscope showed the surface structure to change with increasing age of the needles: depletion and clotting of the waxy texture combined with fungus attack and surface pollution. Two contributions in developing methods of investigation were shown: 1. Our stripping method to separate contents and surface contamination on leaves and needles was tested with radioactive tracers. 2. We worked out a program for the X-ray fluorescence analysis of individual needles. First results show the effect of age on element composition and changing concentrations along the axis of a needle.

26365 (PNL-SA—12528) **Expanded BPA residential weatherization program: summary of regional health effects.** Sandusky, W.F.; Thor, P.W.; Alton, C.C.; Mellinger, P.J.; Cross, F.T. (Pacific Northwest Labs., Richland, WA (USA)). Nov 1984. Contract AC06-76RL01830. 12p. (DOE/EIS—0095F; CONF-8411145—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86007715.

From Annual PNWIS/APCA meeting; Portland, OR, USA (12 Nov 1984).

The Final Environmental Impact Statement (FEIS) for the Bonneville Power Administration (BPA) Expanded Residential Weatherization Program has been completed, printed, and distributed. This document incorporates numerous revisions based on both oral and written comments received during the public comment of the Draft Environmental Impact Statement (DEIS). The estimates of regional health effects were revised to incorporate results of the second Pacific Northwest Residential Energy Survey (PNWRES). The FEIS now expresses the estimated regional health effects in terms of incidence of cancers per 100,000 people exposed, which allows comparison to be made to the annual average risk of fatality by other causes. The estimates of regional health effects are also compared to health effects resulting from supplying and operating a conventional coal plant at a power level equal to the amount of energy saved from installation of additional tightening measures. Numerical results for the estimated health effects described above are provided. A summary of the comments received on the DEIS is also provided, along with estimated health effects associated with the Environmentally Preferred and BPA Preferred Alternatives to the Proposed Action. 8 refs., 3 figs., 5 tabs.

5604 Other Environmental Pollutant Effects

REFER ALSO TO CITATION(S) 26190, 26198, 26205

26366 (AD-A—162900/5/XAB) **ELF (extremely low frequency) biological effects literature data base management system. Final report.** English, J.J.; Kudia, L.M. (IIT Research Inst., Chicago, IL (USA)). Oct 1985. 44p. (IITRI-E—06549-20). NTIS, PC A03/MF A01.

This report describes the functions and operation of the ELF biological effects literature data base management system. It covers functional requirements, system implementation,, data base description, system operations, and detailed procedures. The system utilizes an IBM PC/XT computer and dBASE-III software.

26367 (PB—86-127081/XAB) **Evaluating compliance with FCC-(Federal Communications Commission) specified guidelines for human exposure to radiofrequency radiation.** Cleveland, R.F. (Federal Communications Commission, Washington, DC (USA). Office of Science and Technology). Oct 1985. 58p. (OST/BULL—65). NTIS, PC A04/MF A01.

The technical bulletin provides information and guidelines for use in evaluating compliance with FCC-specified environmental rules dealing with human exposure to radiofrequency (RF) radiation. It provides assistance in determining whether an FCC-regulated facility might create a significant environmental effect due to human exposure to levels of RF radiation in excess of specified radiation-protection guides. Emphasis is placed on exposure from broadcast facilities. However, the bulletin also contains information relevant to certain other RF-emitting sources.

26368 (PNL-SA—13716) Physical interaction of humans and animals with power-frequency electric and magnetic fields. Kaune, W.T. (Pacific Northwest Labs., Richland, WA (USA)). Feb 1986. Contract AC06-76RL01830. 11p. (CONF-860210—3). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86007734.

From IEEE Power Engineering Society winter meeting; New York, NY, USA (2 Feb 1986).

Research has been underway for more than 15 years investigating the biological and physical interactions of power-frequency electric fields coupled to humans and animals through the air dielectric around electric-power facilities. Currently, fairly detailed analyses can be made for homogeneous human- and animal-shaped models standing on ground while exposed to a vertical electric field. Some data are available for ungrounded exposure conditions. However, little is known about the effects of the nonuniform electrical properties of living tissues on induced-current distributions. Recently, interest has also developed in the interaction of humans and animals with power-frequency magnetic fields. Little data are available, and only simple estimates, using homogeneous ellipsodial models, can be made at present. Relatively simple calculational techniques are available, however, to analyze two- and three-dimensional models of humans and animals, and it can be expected that considerable progress will be made in the next few years. 33 refs., 6 figs.

26369 Research into the effects of exposure to high voltage electric fields. Klein, K.W. St. Joseph, MI; American Society of Agricultural Engineers (1984). 14p. (CONF-8406307—).

From Summer meeting on sustaining growth in agricultural productivity; Knoxville, TN, USA (24 Jun 1984).

The Department of Energy (DOE) through its Electric Energy Systems Division has over the past eight years conducted research on the effects of exposure from high voltage to biological tissue. This work has followed classical methods for biological research, i.e. starting with small insects and going to small and then larger animals.

57 HEALTH AND SAFETY

REFER ALSO TO CITATION(S) 26768

26370 (EGG-SSDC—7A) DOE guide to the classification of recordable accidents: injuries and illnesses, property damage incidents, and vehicle accidents. Eicher, R.W.; Walker, J.S. (EG and G Idaho, Inc., Idaho Falls (USA)). Jan 1986. Contract AC07-76ID01570. 118p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE86008178.

These guidelines are intended to simplify the classification and reporting of accidents which occur in DOE operations. They do not attempt to determine the responsibility or to place blame for the purpose of incrimination. They simply serve to aid employers in the correct classification of work-related accidents. The criteria provided in this document do not affect the requirements of DOE orders for reporting of related incidents (e.g., environmental or radiation exposure cases).

26371 (SSDC—29) Barrier analysis. Trost, W.A.; Nertney, R.J. (EG and G Idaho, Inc., Idaho Falls (USA). System Safety Development Center). Jul 1985. Contract AC07-76ID01570. 41p. NTIS, PC A03/MF A01; GPO Dep. File Number DE86008185.

"Barrier Analysis" was written to support the total MORT Program. It is a reminder to the system safety person or the accident investigator that there are three factors to be considered, when evaluating an accident or a potential accident situation. Those three factors are (1) the energy or environmental condition present, (2) the target, the person or object of value, and (3) the barrier and control, those things that are in place or should be in place to keep the energy and the targets apart. These three factors and their relationships to the MORT chart are discussed.

26372 (SSDC—32) Impact of the human on system safety analysis. Nertney, R.J.; Horman, R.L. (EG and G Idaho, Inc., Idaho Falls (USA). System Safety Development Center). Sep 1985. Contract AC07-76ID01570. 34p. NTIS, PC A03/MF A01; GPO Dep. File Number DE86008182.

The impact of the human and human reliability on the results of probabilistic risk assessment studies is discussed in terms of some of the standard models used in risk quantification. Three levels of analysis are considered: (1) identification of areas where the human affects the oprational risks; (2) rough scaling and quantification of the effect of the human on operational outcome; and (3) complete quantification of the risks including consideration of human reliability.

58 GEOSCIENCES

5801 Geology And Hydrology

REFER ALSO TO CITATION(S) 25390, 25412, 26382

26373 (AECL—7825) Influence of sand content on swelling pressures and structure developed in statically compacted Na-bentonite. Gray, M.N.; Cheung, S.C.H.; Dixon, D.A. (Atomic Energy of Canada Ltd., Pinawa, Manitoba. Whiteshell Nuclear Research Establishment). Sep 1984. 31p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85900377.

A laboratory investigation of the vertical and lateral swelling pressures developed in statically compacted, air-dry specimens of sodium (Na)-bentonite:silica sand mixtures as they are saturated in confined conditions with double-distilled, deionized water is described. The results are interpreted with the aid of observations of the compacted soil structures made in a scanning electron microscope. It is shown that the sand acts as an inert filler material and vertical swelling pressures are controlled by a parameter termed the effective clay dry density (qsub(c)). A limiting value of qsub(c) exists below which vertical and lateral swelling pressures do not differ and are theoretically predictable. Above this value, vertical pressures exceed lateral ones. This is related to a change from an isotropic to an anisotropic soil fabric as qsub(c) is increased above the limiting value.

26374 (BMI/ONWI—591) ERG and GRG review of the draft of "preliminary test plan for in situ testing from an exploratory shaft in salt - October 1983". Kalia, H.N. (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). Mar 1986. Contract AC02-83CH10140. 41p. NTIS, PC A03/MF A01; GPO Dep. File Number DE86008473.

The Engineering Review Group (ERG) and Geologic Review Group (GRG) were established by the Office of Nuclear Waste Isolation (ONWI) to help evaluate engineering- and geologic-related issues in the US Department of Energy's nuclear waste repository program. The January 1984 meeting of the ERG and GRG reviewed the In Situ Test Plan (ISTP) titled "Preliminary Test Plan for In Situ Testing From an Exploratory Shaft in Salt - October 1983." This report documents the ERG's and GRG's comments and recommendations on this subject and the ONWI responses to the specific points raised by the ERG and GRG. 6 refs., 2 figs., 1 tab.

26375 (CONF-8509129—3) Fractal geometry of two-dimensional fracture networks at Yucca Mountain, southwestern Nevada: proceedings. Barton, C.C.; Larsen, E. (Geological Survey, Denver, CO (USA); Fenix and Scisson, Inc., Mercury, NV (USA)). 1985. Contract AI08-78ET44802. 11p. CENTEK Publishers, Postadress: S-951 87 Lulea, Sweden. File Number TI86008341.

From International symposium on fundamentals of rock joints; Bjorkliden, Lapland, Sweden (15 Sep 1985).

Fracture traces exposed on three 214- to 260-m^2 pavements in the same Miocene ash-flow tuff at Yucca Mountain, southwestern Nevada, have been mapped at a scale of 1:50. The maps are two-dimensional sections through the three-dimensional network of

strata-bound fractures. All fractures with trace lengths greater than 0.20 m were mapped. The distribution of fracture-trace lengths is log-normal. The fractures do not exhibit well-defined sets based on orientation. Since fractal characterization of such complex fracture-trace networks may prove useful for modeling fracture flow and mechanical responses of fractured rock, an analysis of each of the three maps was done to test whether such networks are fractal. These networks proved to be fractal and the fractal dimensions (D) are tightly clustered (1.12, 1.14, 1.16) for three laterally separated pavements, even though visually the fracture networks appear quite different. The fractal analysis also indicates that the network patterns are scale independent over two orders of magnitude for trace lengths ranging from 0.20 to 25 m. 7 refs., 7 figs.

26376 (NUREG/CR—4496) System for generating long streamflow records for study of floods of long return period. Linsley, R.K.; Kraeger, B.A.; Franz, D.D. (Linsley, Kraeger Associates, Aptos, CA (USA)). Feb 1986. 99p. NTIS, PC A05/MF A01 - GPO. File Number TI86901127.

A stochastic model for the multi-station generation of hourly rainfall has been developed and tested. The model uses a multivariate-normal background process which is continuous. The process is truncated to yield intermittent output as rainfall. The model results showed excellent agreement between a 1000-yr series and observed rainfall. The synthetic rainfall was used with a hydrologic simulation model to develop a synthetic flow record of 1000-yrs. For a portion of the Russian River near Cloverdale, CA tests of these data indicate that they represent the same population used in calibration of the two models.

26377 (ORNL/Sub—85-37733/1) Proceedings of the first hydrology workshop for shale. (Berkeley Hydrotechnique, Inc., CA (USA)). Mar 1986. Contract AC05-84OR21400. 81p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE86008474.

Brief discussion of the federal regulations that apply to geologic repositories and their related information needs are presented in this paper. Reference information establishing the basic features of the reference repository design and the physical properties of shale are also given. An analysis of the required information needs is presented from which research and development needs are established. The research and development needs are then discussed for the general areas of laboratory testing, field/in situ testing, and analytical/numerical modeling development. Research and development needs are summarized, and conclusions and recommendations are presented. 13 refs., 4 figs., 5 tabs.

26378 (UCID—20675) Exact similarity solution for coupled deformation and fluid flow in discrete fractures. Wijesinghe, A.M. (Lawrence Livermore National Lab., CA (USA)). Feb 1986. Contract W-7405-ENG-48. 30p. NTIS, PC A03/MF A01; GPO Dep. File Number DE86008104.

Deformation and fluid flow in fractured rock masses are strongly coupled processes governed by systems of highly nonlinear partial differential equations. Although complex computer codes capable of solving these equations are available, reliable solutions for simple fracture configurations are not available for validating the predictions of these codes, for performing scoping and experimental design calculations, and for interpreting pressure test data for fracture properties. To meet this need, a semi-analytical similarity solution for coupled one-dimensional transient fluid flow and deformation in a single uniform plane fracture was developed, and is presented in this report. The solution was computed for the cubic-law fracture conductivity and constant normal fracture stiffness constitutive relationships. The general solution methodology, however, can be used to obtain solutions for more general constitutive laws and different boundary conditions and problem geometries. Because of its similarity form, this solution provides a compact and convenient means of quantifying the effects of coupled fluid flow and deformation in this simple fracture geometry. More generally, it can be used to estimate whether experiments can be designed to detect and measure the transient fracture aperture and pressure changes that would occur in more complex situations.

5802 Geophysics

REFER ALSO TO CITATION(S) 25626, 26248

26379 (DOE/ER/12082—1) Investigation of MAGMA chambers in the Western Great Basin. Final report, 9 June 1982-31 October 1985. Peppin, W.A. (Nevada Univ., Reno (USA). Seismological Lab.). 10 Feb 1986. Contract AS08-82ER12082. 50p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86007976.

This report summarizes efforts made by the Seismological Laboratory toward the detection and delineation of shallow crustal zones in the western Great Basin, and toward the development of methods to accomplish such detection. The work centers around the recently-active volcanic center near Long Valley, California. The work effort is broken down into three tasks: (1) network operations, (2) data analysis and interpretation, and (3) the study of shallow crustal amomalies (magma bodies). Section (1) describes the efforts made to record thousand of earthquakes near the Long Valley caldera, and focusses on the results obtained for the November 1984 round Valley earthquake. Section (2) describes the major effort of this contract, which was to quantify the large volume of seismic data being recorded as it pertains to the goals of this contract. Efforts described herein include (1) analysis of earthquake focal mechanisms, and (2) the classification, categorization, and interpretation of unusual seismic phases in terms of reflections and refractions from shallow-crustal anomalous zones. Section (3) summarizes the status of our research to date on the locations of magma bodies, with particular emphasis on a location corresponding to the map location of the south end of Hilton Creek fault. Five lines of independent evidence suggest that magma might be associated with this spot. Finally, new evidence on the large magma bodies within the Long Valley caldera, of interest to the DOE deep drilling project, is presented.

26380 (UCRL—94153) SAC, a signal processing system for research seismology. Tull, J.E. (Lawrence Livermore National Lab., CA (USA)). 1986. Contract W-7405-ENG-48. 5p. (CONF-860589—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE86008018.

From Institute for Electrical and Electronics Engineers international conference on circuits and systems; San Jose, CA, USA (5 May 1986).

SAC (Seismic Analysis Code) is a general purpose interactive program designed for the study of sequential signals, especially time-series data. Emphasis has been placed on analysis tools used by research seismologists in the detailed study of seismic events. Analysis capabilities include Fourier transforms, three spectral estimation techniques, IIR and FIR filtering, arithmetic operations, a signal stacking, decimation, and seismic phase picking. SAC also contains a very extensive graphics capability.

5803 Mineralogy, Petrology, And Rock Mechanics

REFER ALSO TO CITATION(S) 25352, 25356, 25358, 25359, 25376, 25387, 25388, 25396, 25398, 25399, 25411, 25412, 26144, 26377

26381 (BMI/ONWI—592) ERG review of salt constitutive law, salt stress determinations, and salt corrosion and modeling studies. Balon, J.E. (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). Mar 1986. Contract AC02-83CH10140. 34p. NTIS, PC A03/MF A01; GPO Dep. File Number DE86008798.

The Engineering Review Group (ERG) was established by the Office of Nuclear Waste Isolation (ONWI) to help evaluate engineering-related issues in the US Department of Energy's nuclear waste repository program. The August 1983 meeting of the ERG reviewed a RE/SPEC technical report containing a review of eight constitutive laws that have been proposed to model the creep of salt over the ranges of stress and temperature anticipated in a nuclear repository. This report documents the ERG's comments and recommendations on this subject and the ONWI responses to the specific points raised by the ERG.

26382 **(CONF-850918—10) Hydrological evaluation of five sedimentary rocks for high-level waste disposal.** Lomenick, T.F.; Kanehiro, B.Y. (Oak Ridge National Lab., TN (USA); Berkeley Hydrotechnique, Inc., CA (USA)). 1986. Contract AC05-84OR21400. 10p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86008975.

From International topical meeting on high level nuclear waste disposal - technology and engineering; Pasco, WA, USA (24 Sep 1985).

Utilizing performance criteria that are based upon siting guidelines issued by DOE for postclosure as well as preclosure conditions, a preliminary hydrologic evaluation and ranking is being conducted to determine the suitability of five sedimentary rocks as potential host rocks for a high-level radioactive waste repository. Based upon both quantitative and qualitative considerations, the hydrological ranking of the rocks in order of their potential as a host rock for the disposal of radioactive wastes would be shale, anhydrock, sandstone, chalk, and carbonates, with the first three rocks being significantly better than the remaining two types.

26383 **(SAND—82-2034) Rock-mass classification of candidate repository units at Yucca Mountain, Nye County, Nevada.** Langkopf, B.S.; Gnirk, P.R. (Sandia National Labs., Albuquerque, NM (USA); RE/SPEC, Inc., Rapid City, SD (USA)). Feb 1986. Contract AC04-76DP00789. 136p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE86008873.

The Nevada Nuclear Waste Storage Investigations (NNWSI) Project managed by the Nevada Operations Office of the Department of energy, is examining the feasibility of siting a repository for high-level radioactive waste at Yucca Mountain, a tuff site on and adjacent to the Nevada Test Site, Nye County, Nevada. Between 1981 and 1983, four tuff units were considered as potential units for emplacement of radioactive waste. Two of the four units are above the water table: the welded, devitrified portion of the Topopah Spring Member of the paintbrush Tuff and the zeolitized, nonwelded portion of the Tuffaceous Beds of Calico Hills. The other two units are below the water table: the welded, devitrified portion of the Bullfrog Member of the Crater Flat Tuff and the welded, devitrified portion of the Tram Member of the Crater Flat Tuff. In this study, available site-specific information from drillholes, supplemented by the needed information from tuff units at other locations, was used in conjunction with two rock-mass-classification systems to evaluate the relative excavation stability of these units. The two rock-mass-classification systems are the South African Council for Scientific and Industrial Research Classification System developed by Bieniawski and the Norwegian Geotechnical Institute Classification System developed by Barton. Two other tuff units located at Rainier Mesa on the Nevada Test Site, the welded portion of the Grouse Canyon Member of the Belted Range Tuff and the nonwelded Tunnel Bed 5, were also evaluated using these rock-mass-classification systems. These last two units were never considered as possible locations for waste emplacement but were evaluated as a basis for comparison with Yucca Mountain units because there are existing stable tunnels in the Rainier Mesa units.

26384 **(SAND—85-2501C) Elastic and viscoelastic calculations of stresses in sedimentary basins.** Warpinski, N.R. (Sandia National Labs., Albuquerque, NM (USA)). 1986. Contract AC04-76DP00789. 42p. (CONF-860567—1). NTIS, PC A03/MF A01; GPO Dep. File Number DE86007149.

From SPE unconventional gas technology symposium; Louisville, KY, USA (18 May 1986).

This study presents a method for estimating the stress state within reservoirs at depth using a time-history approach for both elastic and viscoelastic rock behavior. Two features of this model are particularly significant for stress calculations. The first is the time-history approach, where we assume that the present in situ stress is a result of the entire history of the rock mass, rather than due only to the present conditions. The model can incorporate: (1) changes in pore pressure due to gas generation; (2) temperature gradients and local thermal episodes; (3) consolidation and diagenesis through time-varying material properties; and (4) varying tectonic episodes. The second feature is the use of a new viscoelastic model. Rather than assume a form of the relaxation function, a complete viscoelastic solution is obtained from the elastic solution through the viscoelastic correspondence principal. Simple rate models are then applied to obtain the final rock behavior. Example calculations for some simple cases are presented that show the contribution of individual stress or strain components. Finally, a complete example of the stress history of rocks in the Piceance basin is attempted. This calculation compares favorably with present-day stress data in this location. This model serves as a predictor for natural fracture genesis and expected rock fracturing from the model is compared with actual fractures observed in this region. These results show that most current estimates of in situ stress at depth do not incorporate all of the important mechanisms and a more complete formulation, such as this study, is required for acceptable stress calculations. The method presented here is general and is applicable to any basin having a relatively simple geologic history. 25 refs., 18 figs.

5804 Geochemistry

REFER ALSO TO CITATION(S) 25388

5805 Oceanography

26385 **Observations of Gulf Stream-induced and wind-driven upwelling in the Georgia Bight using ocean color and infrared imagery.** McClain, C.R.; Pietrafesa, L.J.; Yoder, J.A. (NASA Goddard Space Flight Center, Greenbelt, MD). *Journal of Geophysical Research;* **89**: No. C3, 3705-3723(20 May 1984).

Ocean color and infrared imagery from aircraft and satellite sensors are combined with in situ measurements of currents, chlorophyll, temperature, salinity, coastal winds, and sea level to study upwelling events in the Georgia Bight where the Gulf Stream and continental shelf waters strongly interact. These interactions were observed over an 8 day period in April 1980 during which five independent upwellings occurred. The upwellings included a nearshore wind-driven upwelling enhanced by topographic effects, three Gulf Stream filament-induced upwellings, and what appears to have been a Gulf Stream meander-induced event. The chlorophyll distributions as inferred from the imagery are found to be reliable tracers which indicate filamentary circulation and propagation and advective routes by which nearshore water moves offshore. The propagation of two of the filaments and the meander are studied in detail using the imagery and mooring array temperature time series. Both techniques yield nearly identical results for the phase speeds of each event. There is evidence that one of the filaments accelerated as it entered into the Charleston Bump area where the Gulf Stream deflects offshore. The other filament exhibited a steady deceleration as it moved past Cape Canaveral and eventually lost any semblance of wave motion. Also included are data from April 1979 which offer corroborating evidence of filamentary structure and circulation. Intercomparisons of field measurements and the Nimbus 7/coastal zone color scanner estimates of surface pigment concentrations show excellent agreement over the range of 0.1-7.0 mg/m^3. 54 references, 22 figures, 6 tables.

64 PHYSICS I

6401 Astrophysics And Cosmology

REFER ALSO TO CITATION(S) 25942, 25942, 26003, 26089, 26422, 26423, 26517, 26530, 26629

26386 **(AD-A—161608/5/XAB) Spectral imaging with a cid camera. Final report, 4 February 1982-14 September 1984.** Tarbell, T.D. (Lockheed Missiles and Space Co., Palo Alto, CA (USA)). 22 Mar 1985. 84p. (LMSC/F—059543). NTIS, PC A05/MF A01.

This report describes a program of spectral imaging observations of the solar atmosphere using the Sacromento Peak Vacuum Tower Telescope. The observations were obtained with Lockheed instruments including: an active tilt mirror for image motion compensation; polarization analyzer; narrowband tunable birefringent filter; photoelectric cid array camera; digital video image processor;

and a microcomputer controller. Five observing runs were made, three of them with the entire system in operation. The images obtained were processed to measure magnetic and velocity fields in the solar photosphere with very high spatial resolution - 0.5 arcseconds on the best frames. Sets of these images have been studied to address three scientific problems; (1) The relationship among small magnetic flux tubes, downdrafts and granulation; (2) The puzzling flux changes in isolated magnetic features in a decaying active region; (3) The temporal power spectrum of the magnetogram signal in isolated flux tubes. Examples of the narrowband images are included in the report, along with abstracts and manuscripts of papers, resulting from this research.

26387 **(AD-A—162094/7/XAB) Cosmic rays and heavy-ion environments.** Shea, M.A. (Air Force Geophysics Lab., Hanscom AFB, MA (USA)). 1984. 13p. (AFGL-TR—85-0285). NTIS, PC A02/MF A01.

A brief overview of the cosmic radiation and heavy-ion environment in near-earth space is presented. Both galactic cosmic radiation and energetic particles expected from solar proton events are reviewed.

26388 **(AD-A—162123/4/XAB) Fast-drift kilometric bursts and solar-proton events.** Cliver, E.W.; Kahler, S.W.; Cane, H.V.; McGuire, R.E.; von Rosenvinge, T.T. (Air Force Geophysics Lab., Hanscom AFB, MA (USA)). 1985. 6p. (AFGL-TR—85-0287). NTIS, PC A02/MF A01.

Initial results are presented of a comparative study of major fast-drift kilometric bursts and solar-proton events from Sep 1978-Feb 1983. It was found that only about half of all intense, long duration (> 40 min above 500 sfu) 1-MHz bursts can be associated with E > 20-MeV proton events. However, for the subset of such fast-drift bursts accompanied by metric Type II and or IV activity (about 40% of the total), the degree of association with > 20 MeV events is 80%. For the reverse association, it was found that proton events with J (> 20 MeV)>.01 pr/sq cm/s/sr/MeV were typically (about 80% of the time) preceded by intense 1-MHz bursts that exceeded the 500 sfu level for times > 20 min (median duration about 35 min).

26389 **(AD-A—162124/2/XAB) North-south asymmetry in activity on the sun and cosmic-ray density gradients.** Swinson, D.B.; Shea, M.A.; Humble, J.E. (Air Force Geophysics Lab., Hanscom AFB, MA (USA)). 1985. 6p. (AFGL-TR—85-0286). NTIS, PC A02/MF A01.

One method of detecting a perpendicular cosmic-ray density gradient (vNp) is to make use of the contribution of the drift term B x vNp to the solar cosmic-ray diurnal variation. The B x vNp term produces a flow in the ecliptic plane perpendicular to the IMF B, with the sense of the flow depending upon the sense of B; this field-dependent flow adds vectorially to the usual azimuthal streaming which produces a cosmic-ray intensity maximum at 18 hours solar time (after correction for geomagnetic bending). In the case of a southward perpendicular gradient, when the IMF is away from the sun, the resultant diurnal variation should have a larger amplitude, and the time of maximum should occur a little earlier, whereas if the IMF is toward the sun, the resultant diurnal variation should have a small amplitude with a later time of maximum. This method is used to analyze neutron-monitor and underground muon data, separated according to IMF sense, from 1965 to 1975, to show that there is a perpendicular cosmic-ray gradient that pointed southward prior to 1969, and a suggested northward pointing gradient after the reversal of the sun's polar magnetic field in 1969-71.

26390 **(AD-A—162175/4/XAB) Update on the correlation between the cosmic-radiation intensity and the geomagnetic aa index.** Shea, M.A.; Smart, D.F. (Air Force Geophysics Lab., Hanscom AFB, MA (USA)). 1985. 6p. (AFGL-TR—85-0296). NTIS, PC A02/MF A01.

A statistical study between the cosmic-ray intensity, as observed by a neutron monitor, and of the geomagnetic aa index, as representative of perturbations in the plasma and interplanetary magnetic field in the heliosphere, has been updated to specifically exclude time periods around the reversal of the solar magnetic field. The results of this study shows a strong negative correlation for the period 1960 through 1968 with a correlation coefficient of approximately -0.86. However, there is essentially no correlation between the cosmic ray intensity and the aa index for the period 1972-1979 (i.e. correlation coefficient less than 0.16). These results would appear to support the theory of preferential particle propagation into the heliosphere via the ecliptic during the period 1960-1968 and via the solar polar regions during 1972-1979.

26391 **(AD-A—162191/1/XAB) Application of microwave spectroscopy to the study of coronal field changes associated with a disappearing sunspot.** Hurford, G.J. (California Inst. of Tech., Pasadena (USA)). Mar 1985. 18p. (SCIENTIFIC—1). NTIS, PC A02/MF A01.

A critical physical parameter affecting solar activity is the distribution of coronal magnetic fields. Microwave observations provide the only technique for the quantitative measurement of these fields. This report presents the preliminary analysis of high spatial and spectral resolution observations designed to measure the distribution and evolution of the coronal magnetic fields of a disappearing sunspot. Data at 56 frequencies between 1.2 and 14 GHz were acquired with the three-element frequency-agile interferometer. This system directly measured the size of coronal microwave sources at each frequency and polarization. The temperature of the source was determined from the ratio of source flux to area. This yielded the size and brightness temperature spectra of the microwave sources associated with a sunspot as it disappeared over three successive days. On the basis of gyroresonance opacity, the corona would be expected to be opaque at microwave frequencies at surfaces corresponding to specific values of coronal field strength. The overall form of the observed spectra was consistent with such expectations, although there were differences of potential physical significance.

26392 **(AD-A—162320/6/XAB) X-ray line ratios for Fe XVII observed in the solar corona. Technical report.** Rugge, H.R.; McKenzie, D.L. (Aerospace Corp., El Segundo, CA (USA). Space Sciences Lab.). 2 Dec 1985. 36p. (TR—0086(6940-01)-1). NTIS, PC A03/MF A01.

Selected solar spectra from the SOLEX B x-ray spectrometers aboard the USAF P78-1 satellite were analyzed in order to compare Fe XVII line flux ratios with theory. The spectra were chosen to cover a wide range of solar activity from quiescent active regions to large flares. For purposes of comparison with theory, a temperature scale based on a ratio of Fe XVIII to Fe XVII line fluxes was derived. Fe XVII line ratios involving one line with a 3s outer electron in the upper state and the other with a 3d electron are potentially the most useful, since such ratios are predicted, by theory, to have a significant temperature dependence. The data do not support the theoretical predictions. The dependence of the 3s/3d line ratios on temperature is found to be very weak, and the ratios are unlikely to be useful as temperature diagnostics. Measurements of the ratios involving only 3s upper levels or only 3d upper levels also disagree with theory. Improved theoretical calculations are needed to interpret the large amount of high-quality data that are now becoming available.

26393 **(AD-A—162425/3/XAB) Energetic protons from a disappearing solar filament.** Kahler, S.W.; Cliver, E.W.; Cane, R.E.; McGuire, H.V.; Stone, R.G. (Emmanuel Coll., Boston, MA (USA)). 1985. 6p. NTIS, PC A02/MF A01.

A solar energetic (E> 50MeV) particle (SEP) event observed at 1 AU began about 1500 UT on 1981 December 5. This event was associated with a fast coronal mass ejection observed with the Solwind coronagraph on the P78-1 satellite. No metric type II or type IV burst was observed, but a weak interplanetary type II burst was observed with the low-frequency radio experimentation ISEE-3 satellite. The mass ejection was associated with the eruption of a large solar quiescent filament that lay well away from any active regions. The eruption resulted in a H-alpha double-ribbon structure which straddled the magnetic inversion line. No impulsive phase was obvious in either the H-alpha or the microwave observations. The event indicates that neither a detectable impulsive phase nor a strong or complex magnetic field is necessary for the production of energetic ions.

26394 (AD-A—162426/1/XAB) Suggested standardization format for cosmic-ray ground-level event data. Shea, M.A.; Smart, D.F.; Wada, M.; Inoue, A. (Air Force Geophysics Lab., Hanscom AFB, MA (USA)). 1985. 6p. (AFGL-TR—85-0302). NTIS, PC A02/MF A01.

A standardized format is suggested for the archival and exchange of neutron-monitor data obtained during solar-flare-initiated ground-level cosmic-ray events. Using the data for the 7 May 1978 ground-level event, a format was developed that incorporates hourly data preceding and following the event and small-time interval data immediately before and during the event. Provision was made for the inclusion of uncorrected and corrected data as well as the atmospheric pressure. The cosmic-ray intensity data are then reduced to a standard counting rate of counts per second facilitating the graphing and comparison of these data for various analyses.

26395 (AD-A—162438/6/XAB) Buoyant magnetic flux tubes. II. Three-dimensional behavior in granules and supergranules. Schmidt, H.U.; Simon, G.W.; Weiss, N.O. (Air Force Geophysics Lab., Hanscom AFB, MA (USA)). 1985. 17p. (AFGL-TR—85-0303). NTIS, PC A02/MF A01.

A simple model is used to study the interaction of isolated magnetic flux tubes with convection in the sun. Convective motion in granules and supergranules is represented by prescribed flows in three-dimensional cells with square cross sections and thin flux tubes mode under the action of magnetic buoyance, Lorentz curvature forces, and aerodynamic drag. Inflow at the base of a cell competes with outflow at its upper surface; small flux tubes tend to be swept to the cell boundaries while larger, more buoyant tubes are dragged to the axis of the cell. These results are compared with recent observations of small-scale granular and intergranular magnetic fields.

26396 (AD-A—162588/8/XAB) Empirical model for the earth's cosmic-ray shadow at 400 km: prohibited cosmic-ray access. Humble, J.E.; Smart, D.F.; Shea, M.A. (Air Force Geophysics Lab., Hanscom AFB, MA (USA)). 1985. 6p. (AFGL-TR—85-0312). NTIS, PC A02/MF A01.

It is possible to construct a unit sphere of access that describes the cosmic radiation allowed to an earth-orbiting spacecraft. In the upper hemisphere of the allowed portion of the cosmic-ray sphere of access, the cosmic-ray cutoffs can be ordered by application of Stormer theory in offset dipole coordinates. In the downward hemisphere, in westerly directions, the cosmic radiation is allowed at large zenith angles well below the spacecraft-earth horizon, with particles being able to reach satellites at 400-km altitude from large zenith angles of similar to 140 deg at azimuthal directions equatorward of west in both the northern and southern hemispheres. It was found possible to model the occluded portion of the cosmic-ray sphere of access as a circular projection having a diameter bounded by the satellite-earth horizon. Maintaining tangency at the eastern each of the spacecraft-earth horizon, this optically occluded area is projected downward (toward the earth) by angle beta which is a function of the magnetic field inclination and cosmic-ray arrival direction. This projected plane, corresponding to the forbidden area of cosmic-ray access, is bounded by the spacecraft-earth horizon in easterly directions, and is rotated around the vertical axis by an angle alpha from the eastern direction, where the angle alpha is a function of the offset dipole latitude of the spacecraft.

26397 (AD-A—162717/3/XAB) Statistical study of solar type III bursts and auroral kilometric radiation onsets. Farrell, W.M.; Gurnett, D.A. (Iowa Univ., Iowa City (USA). Dept. of Physics and Astronomy). 1 Oct 1985. 9p. NTIS, PC A02/MF A01.

Simultaneous occurrences of type III solar radio bursts and auroral kilometric radiation were observed by Calvert using ISEE 1 spectrograms. He presented evidence suggesting that the incoming type III burst stimulates the onset of auroral kilometric radiation (AKR). This paper presents a statistical study of the correlation between type III bursts and auroral kilometric radiation. A superposed epoch analysis was performed on as many as 186 type III events. The type III bursts were detected by the ISEE 3 spacecraft on the sunward side of the earth. At the same time the IMP 8 spacecraft was used to detect onsets of kilometric radiation on the nightside of the earth. For each event the intensities measured by ISEE 3(type III intensities) were subtracted from the intensities measured by IMP 8 (type III and possible AKR intensities). The resulting intensities for each event were then added to determine if kilometric radiation was preferentially observed following a type III burst. This analysis was performed at frequencies of 100, 178, and 500 kHz. The results of this study show that a statistically significant correlation exists between incoming type III bursts from the sun and kilometric radiation from the earth.

26398 (AD-A—162835/3/XAB) Observations of a solar latitude-dependent limb brightness variation. Kuhn, J.R.; Libbrecht, K.G.; Dicke, R.H. (Princeton Univ., NJ (USA). Dept. of Physics). 15 Mar 1985. 8p. NTIS, PC A02/MF A01.

A small latitude-dependent photospheric excess-brightness variation was observed from 131 days of data obtained with the Princeton Solar Distortion Telescope. Using an analytic model to separate the influence of faculae from the brightness signal, the authors obtained, for the summer of 1983, a temperature difference of 0.6 + or - 0.1 K between the poles and the regions at + or - 53° solar latitude, with the polar regions being hotter.

26399 (AD-A—162861/9/XAB) Two-dimensional compressible convection extending over multiple scale heights. Hurlburt, N.E.; Massaguer, J.M. (Colorado Univ., Boulder (USA)). 15 Jul 1984. 19p. NTIS, PC A02/MF A01.

Two-dimensional simulations are used to study fully compressible thermal convection spanning multiple-density scale heights typical of a stellar envelope. The fluid is assumed to be a perfect gas with constant thermal conductivity and dynamic viscosity. The unstably stratified layer is thus represented by a polytropic index typically taken to be n = 1 (with n = 3/2 equivalent to an adiabatic stratification). The mean density ratio (bottom to top of the layer) ranges from about 1 to 21, with Rayleigh numbers up to about 1000 times critical. These highly nonlinear flows are studied with a two-dimensional numerical scheme based on a modified two-step Lax-Wendroff method. The convective motions in these simulations span the full height of the unstable layer, with no tendency to form a succession of rolls in the vertical as has been assumed in mixing length treatments of convection. Further, the flows remain subsonic because the center of the cell shifts toward the bottom of the layer as the density stratification is strengthened. The flows then display prominent downward-directed plumes surrounded by broader regions of upflow. The flow asymmetry leads to a kinetic energy flux which is directed downward, whereas the enthalpy or convective flux is upward. such asymmetry comes about because pressure fluctuations accentuate buoyancy driving in the downward plumes and can lead to buoyancy braking in the surrounding ascending flows. Compressional work is significant in the overall energetics.

26400 (AD-A—162870/0/XAB) Frequent ultraviolet brightenings observed in a solar active region with Solar Maximum Mission. Porter, J.G.; Gebbie, K.B. (Colorado Univ., Boulder (USA)). 15 Aug 1984. 9p. NTIS, PC A02/MF A01.

Observations in the ultraviolet of sites of enhanced intensity within an active region on the Sun reveal frequent and rapid brightenings in Si IV and O IVline emission. These transition region lines were observed with 0.08 s sampling in time using the Ultraviolet Spectrometer and Polarimeter (UVSP) instrument on the Solar Maximum Mission (SMM) satellite. The observations suggest that intermittent heating events of modest amplitude are occurring at many sites within an active region. By selecting the brightest site at any given time within an active region and then sampling its behavior in detail within a 120-s interval, it was found that about two-thirds of the samples showed variations of the Si IV line intensity. The brightenings typically lasted about 40-60 s, though some were as brief as 20 s. Intensity increases of about 20%-100% were commonly observed. It appears that the uv emission may be coming mostly from small unresolved elements within the spatial sampling window of 3 x 3 inches. Some modulations in intensity are found to correlate with the jitter in the satellite pointing: this allows us estimates of the possible size and contrast of these bright

elements. The relatively weak brightenings reported here occur much more frequently than those of larger amplitude detected with OSO 8; the energetic events classified as flares are much rarer yet. These results suggest that heating due to magnetic-field reconnection within an active region is proceeding almost stochastically; events involving only a modest release of energy occur the most frequently.

26401 (AD-A—162871/8/XAB) New measurement of the facular contrast near the solar limb. Libbrecht, K.G.; Kuhn, J.R. (Princeton Univ., NJ (USA). Dept. of Physics). 15 Feb 1984. 9p. NTIS, PC A02/MF A01.

A new measurement of the contrast of solar faculae at 525 nm and 800 nm is presented using photometer data taken during the summer of 1982. The authors find that the contrast is decreasing with heliocentric angle Theta from mu approx. 0.2 to mu approx. 0.08, where mu = cos Theta. Parameterizing the contrast function with (Delta I)/I = 0.2 + alpha(mu - 0.2) over the range 0.08 < or = mu < or = 0.2, they obtain the best fit values of alpha: alpha(green) = 0.33 + or - 0.14, and alpha(red) = 0.25 + or - 0.08. These results differ from the facular contrast measurement of Chapman and Klabunde, who find the contrast increasing toward the limb. Selection effects in their data are suggested that could explain the discrepancy. These results are in good agreement with the facular model of Spruit, assuming a fixed magnetic field strength of 2000 gauss.

26402 (AD-A—162982/3/XAB) Penetrative cellular convection in a stratified atmosphere. Massaguer, J.M.; Latour, J.; Toomre, J.; Zahn, J.P. (Colorado Univ., Boulder (USA). Dept. of Astrophysical Science). 1984. 17p. NTIS, PC A02/MF A01.

Penetrative convection was investigated within a simple compressible model consisting of three layers of differing stratification prior to the onset of convection. The middle one is a convectively unstable polytrope bounded above and below by two stably stratified polytropes. Nonlinear anelastic modal equations are used to describe these convective motions. Penetrative boundary conditions are imposed at the top and bottom of the computational domain. One- and two- mode steady solutions with hexagonal planforms were studied for Rayleigh numbers up to about 1000 times critical, and for a range of Prandtl numbers, horizontal wavenumbers and stratifications. These show that: 1) Penetration into the lower stable layer by downward-directed plumes is substantially larger in a stratified medium than in a Boussinesq fluid, and produces an extended region of adiabatic stratification. 2) Overshooting into the upper stable layer can be sharply diminished by a reversal of the buoyancy occurring in the upper part of the unstable zone if the stratification is strong enough. These effects are all related to large pressure perturbations that arise in such convective flows. The strong asymmetry between upward and downward penetration in compressible media has major implications for the mixing of stable regions above and below stellar convection zones.

26403 (AD-A—163068/0/XAB) Seismology of the sun. (Colorado Univ., Boulder (USA). Dept. of Astrophysical Science). 6 Sep 1985. 12p. NTIS, PC A02/MF A01.

Oscillations of the sun make it possible to probe the inside of a star. The frequencies of the oscillations have already provided measures of the sound speed and the rate of rotation throughout much of the solar interior. These quantities are important for understanding the dynamics of the magnetic cycle and have a bearing on testing general relativity by planetary precession. The oscillation frequencies yield a helium abundance that is consistent with cosmology, but they reinforce the severity of the neutrino problem. They should soon provide an important standard by which to calibrate the theory of stellar evolution.

26404 (AD-A—163091/2/XAB) Confirmation of a 152-day periodicity in the occurrence of solar flares inferred from microwave data. Bogart, R.S. (Stanford Univ., CA (USA). Center for Space Science and Astrophysics). Sep 1985. 12p. (CSSA-ASTRO—85-20). NTIS, PC A02/MF A01.

Evidence for a periodicity of about 155 + or - 5 days in the production of energetic solar flares has been reported by Rieger et al. (1984) and Kiplinger et al. (1984). The data on which these analyses were based are restricted to the years 1980 through early 1984. To see whether this periodicity is a persistent phenomenon, the occurrences of flares inferred from microwave data were exaimned, which are available for most of the present and previous solar cycles. Strong confirmation of a 152-day periodicity was in the time interval previously studied, demonstrating that these flares are a useful indicator for the observed periodicity. Evidence was found persistence of the periodicity in the previous cycle (Cycle 20). In Cycle 20 the periodic modulation of the flare occurrence rate was weaker than in Cycle 21, but the phase has apparently remained coherent through both cycles.

26405 (AD-A—163098/7/XAB) Dynamical models of coronal transients and interplanetary disturbances. Dryer, M.; Smart, D.F. (National Oceanic and Atmospheric Administration, Boulder, CO (USA)). 30 Dec 1985. 11p. NTIS, PC A02/MF A01.

The authors review the status of the best off-the-shelf tool available for the study of dynamical behavior of coronal transients and traveling interplanetary disturbances. This tool involves numerical solution of the initial-boundary value problem of multi-dimensional time-dependent magnetohydrodynamics. While this tool cannot address questions of turbulence and kinetic behavior, it is suggested that deeper understanding of large-scale phenomena can be obtained by direct comparison of the MHD models with multidisciplinary synoptic observations of specific events on the sun, and in the corona and interplanetary space. Conclusions reached after a recent critique (based on limited set of observational and numerical data) of the MHD paradigm's application to coronal transients are examined and found to have limited validity. Substantial observational progress was achieved during SMY though ground- and space-based observations of solar and interplanetary events. Many of these observations can confidently be associated with one another for specific events.

26406 (AD-A—163104/3/XAB) Superactive regions and production of major solar flares. (Stanford Univ., CA (USA). Center for Space Science and Astrophysics). Oct 1985. 8p. (CSSA-ASTRO—85-24). NTIS, PC A02/MF A01.

The success of imaging detectors with small fields of view such as HXIS or the Pinhole/Occulter Facility (P/OF) depends strongly on the ability to point to the right place at the right time. During solar-maximum years, many active regions coexist on the solar disk. Therefore, to order the imaging detector to the right plane, it is important to know which active region is most likely to produce major flares. This knowledge is also important for flare prediction.

26407 (AD-A—163105/0/XAB) Two classes of gamma-ray/proton flares: impulsive and gradual. Revision. (Stanford Univ., CA (USA). Center for Space Science and Astrophysics). Nov 1985. 59p. (CSSA-ASTRO—85-26-REV). NTIS, PC A04/MF A01.

Various properties of gamma ray/proton flares, which produce nuclear gamma rays and/or interplanetary energetic protons were studied. Two classes of gamma ray/proton (GR/P) flares were found to exist, with each class having many distinct characteristics in common. Gradual GR/P flares (so named because of gradual variations of hard x-ray fluxes with duration of spike bursts longer than 90 s) have the following characteristics: long-duration (> 10 min) hard / x-ray and microwave emission, gradual variation of microwave flux, relatively large ratios of microwave to hard x-ray fluxes, large H-alpha areas, long-duration soft x-ray emission (> 1 hr), hard x-ray emission from extended coronal loops, interplanetary type II emission, coronal mass ejections, and production of large numbers of interplanetary energetic protons. Impulsive GR/P flares display directly opposing behavior in the above respects. However, the two classes of GR/P flares have a few characteristics common to both of them.

26408 (AD-A—163318/9/XAB) Helioseismology. Leibacher, J.W.; Noyes, R.W.; Ulrich, R.K. (Colorado Univ., Boulder (USA). Dept. of Astrophysical Science). Sep 1985. 12p. NTIS, PC A02/MF A01.

Acoustic waves within the sun are visible as oscillations on the solar surface. Their pattern and period hold clues to structure, composition and dynamics in the sun's interior. Now a new tool, helioseismology, is making it possible to penetrate the opaque brillance of the solar surface. Continuous wave motions that are somewhat like seismic waves in the earth agitate the interior of the sun. In much the same way as geophysicists study seismic waves to learn about conditions within the earth, solar physicists are exploiting oscillations observed on the sun to probe its interior.

26409 **(CBPF-NF—016/85) Class of inhomogeneous Goedel-type models.** Reboucas, M.J.; Tiomno, J. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1985. 13p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701525.

A class of inhomogeneous Goedel-type solutions of Einstein's field equations is studied. The source of the geometries is a fluid with heat flow plus a scalar field. The thermodynamic properties of one specific solution are discussed.

26410 **(CBPF-NF—017/85) Exact cosmological solutions of Einstein-Maxwell equations as perturbations of the Bertotti-Robinson model.** Portugal, R.; Soares, I.D. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1985. 15p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701526.

Two new classes of spatially homogeneous cosmological solutions of Einstein-Maxwell equations are obtained by considering a class of exact perturbations of the static Bertotti-Robinson (BR) model. The BR solution is shown to be unstable under these perturbations, being perturbed into exact cosmological solutions with perfect fluid (equations of state p = lambda rho, O < = lambda < = 1), isotropic/anisotropic expansion and non-null electric conductivity.

26411 **(INFN/AE—85-3) Considerations about the apparent superluminal expansions in astrophysics.** Recami, E.; Castellino, A.; Maccarrone, G.D.; Rodono, M. (Istituto Nazionale di Fisica Nucleare, Rome (Italy); Catania Univ. (Italy)). 1985. 21p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701527.

The orthodox models devised to explain the apparent "superluminal expansions" observed in astrophysics, and here briefly summarized and discussed together with the experimental data, do not seem to be too successful, especially when confronted with the most recent observations, suggesting complicated expansion patterns, even with possible accelerations. At this point it may be, therefore, of some interest to explore the possible alternative models in which actual superluminal motion takes place. To prepare the ground one starts from a variational principle, introduces the elements of a tachyon mechanics within special relativity, and argues about the expected behaviour of tachyonic objects when interacting (gravitationally, for instance) among themselves or with ordinary matter. Then the simplest "superluminal models", paying particular attention to the observations which they would give rise to are reviewed and developed. It is concluded that some of them appear to be physically acceptable and are statistically favoured with respect to the orthodox ones.

26412 **(LBL—20859) Relativistic field theory of neutron stars and their hyperon populations.** Glendenning, N.K. (Lawrence Berkeley Lab., CA (USA)). Jan 1986. Contract AC03-76SF00098. 14p. (CONF-860160—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE86008375.

From 14. international workshop on the gross properties of nuclei and nuclear excitation; Hirschegg, Austria (13 Jan 1986).

The nuclear many-body problem is examined by means of the formulation of an effective relativistic field theory of interacting hadrons. A relativistic field theory of hadronic matter is especially appropriate for the description of hot or dense matter, because of the appearance of antiparticles and higher baryon resonances and because it automatically respects causality. 8 refs., 7 figs., 1 tab. (WRF)

26413 **(RRK—84-15) Scalar perturbations at the reheating phase in a new inflationary universe.** Den, Mitsue; Tomita, Kenji. (Hiroshima Univ., Takehara (Japan). Research Inst. for Theoretical Physics). Jul 1984. 26p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86701528.

In order to analyze the behaviors of energy density perturbations and the perturbation of classical scalar field in a new inflationary universe, we solved their coupled equations, which are due to Sasaki's extension of Bardeen's gauge-invariant formalism for gravitational instability. We integrated from an initial time at the rolling phase, when the size of perturbations corresponding to present galaxies far exceeded the horizon length, to a final time when reheating was over and radiation was dominant. It is shown that the relative density perturbations at the later time of horizon crossing are much smaller (say, by a factor 10^5) than the values (--50) in the previous results by Bardeen et al. and others, and can be consistent with the value -10^4 which may be appropriate to galaxy formation. Because of this distinction, it is concluded that the scalar field perturbation plays an important role to raise the density perturbation at the reheating phase.

26414 **(RRK—84-17) Galactic luminosity functions and galaxy formation in a neutrino-dominated universe.** Tomita, Kenji. (Hiroshima Univ., Takehara (Japan). Research Inst. for Theoretical Physics). Jul 1984. 13p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701524.

Based on our theory for galaxy formation from entropy perturbations in a neutrino-dominated universe, we try to explain the universal bending in galactic luminosity functions. It is shown that in the case of neutrino mass asymptotically equaling 30 ev, a consistent scenario can be made, if large amplitudes of entropy perturbations ((delta rho sub(g)/rho sub(g)) sub(rec) asymptotically equals 3) exist.

26415 **(RRK—84-19) On a quantized scalar field in the de Sitter and Nariai universes.** Nariai, Hidekazu. (Hiroshima Univ., Takehara (Japan). Research Inst. for Theoretical Physics). Aug 1984. 16p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701529.

After canonical quantization of a massive or massless scalar field in the de Sitter and Nariai universes (both of which satisfy the same Einstein equations with a non-vanishing cosmological constant, $R_{sub}(\mu\nu)=A_{gsub}(\mu\nu)$, but their topological structures differ from each other), the uniquely obtained 4-dimensional commutation functions in both universes are comparatively studied with due emphasis on their topological structures, as well as the difference of couplings to the background universe.

26416 **(RRK—84-20) Oscillatory models in Kaluza-Klein cosmology.** Tomimatsu, Akira; Ishihara, Hideki. (Hiroshima Univ., Takehara (Japan). Research Inst. for Theoretical Physics). Aug 1984. 15p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701530.

We investigate the dynamical behaviour of a 7-dimensional, homogeneous, cosmological model. Anisotropy is prevailed all over the spatial dimensions constituting a manifold of a direct product of two three-spheres ($S^3 x S^3$). It is found that the universe evolves from an initial Kasner epoch towards a final one through repetitious oscillations of the scale factors, and on the way of the evolution its total volume turns to decrease. No chaotic behaviour is present near the singularities. For the vacuum case, its spatial sections in the final state are not always split into expanding S^3 and contracting S^3. However, the effect of matter which tends to isotropise each S^3 can resolve this difficulty.

26417 **(UCRL—53713) Physical processes in collapse driven supernova.** Mayle, R.W. (Lawrence Livermore National Lab., CA (USA)). Nov 1985. Contract W-7405-ENG-48. 236p. NTIS, PC A11/MF A01; 1; GPO Dep. File Number DE86007792.

A model of the supernova explosion is discussed. The method of neutrino transport is discussed, since the explosive mechanism depends on neutrino heating of the material behind the accretion shock. The core region of these exploding stars becomes unsta-

ble to convective motions during the supernova evolution. Convective mixing allows more neutrinos to escape from under the neutrinosphere, and thus increases the amount of heating by neutrinos. An approximate method of incorporating convection is described, and some results of including convection in a computer model is presented. Another phenomena is seen in computer simulations of supernova, oscillations in the neutrino luminosity and mass accretion rate onto the protoneutron star. The last topic discussed in this thesis describes the attempt to understand this oscillation by perturbation of the steady state solution to equations approximating the complex physical processes occurring in the late time supernova. 42 refs., 31 figs.

26418 **Thermodynamics in Kaluza-Klein theories.** Tosa, Y. (Department of Physics, University of Colorado, Campus Box 390, Boulder, Colorado 80309). *Physical Review [Section] D: Particles and Fields;* 33: No. 8, 2326-2332(15 Apr 1986).

The topological effects on thermodynamics are investigated for massless particles on a sphere and a product of two spheres.

26419 **Optical and infrared pulsations from the HZ Herculis binary system during the 1983 prolonged X-ray low state.** Middleditch, J.; Puetter, R.C.; Pennypacker, C.R. (Los Alamos National Lab., NM; California Univ., La Jolla; California Univ., Berkeley). *Astrophysical Journal;* 292: 267-275(May 1985).

Pulsed infrared and optical flux from HZ Her has been detected during the 1983 prolonged X-ray low state by simultaneous observations with the Lick Observatory Shane 3.1 m and Crossley 91 cm telescopes. The pulsed fluxes in the 1.0-2.5-micron bandpass and the 3200-7500 A bandpass agree in pulse frequency and phase and were measured to be 31 and 13 microJy, respectively. These pulsed fluxes indicate that the reprocessed pulsation spectrum is consistent with optically thin thermal bremsstrahlung radiation with a characteristic temperature of 25,000 K (+25,000; -12,500) which is modulated in intensity. An apparent earth-approaching Doppler velocity of about 65 km/s is observed for these pulsed fluxes; this velocity can be interpreted as pulsed X-ray reprocessing by material in the mass transfer stream between L1 and the outer edge of the accretion disk. Other optical observations made during and before the 1983 prolonged X-ray low state show that the optical pulsations may have been subtly affected by the obscuration responsible for the X-ray low. 21 references.

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REFER ALSO TO CITATION(S) 26134, 26390, 26396, 26397, 26397

26420 **(AD-A—162145/7/XAB) High-level spacecraft charging in the low-altitude polar auroral environment.** Gussenhoven, M.S.; Hardy, D.A.; Rich, F.; Burke, W.J.; Yeh, H.C. (Air Force Geophysics Lab., Hanscom AFB, MA (USA)). 1 Nov 1985. 16p. (AFGL-TR—85-0291). NTIS, PC A02/MF A01.

Regions of intense keV-electron precipitation, such as inverted-V structures, at times colocate with ionospheric-plasma depletion regions in the high-latitude polar ionosphere. When Defense Meterological Satellite Program (DMSP) F6 and F7 satellites, at 840 km, enter these regions in darkness, ion signatures of high spacecraft-to-ambient plasma potential differences(several hundred volts negative) are observed with the new SSJ/4 ion detectors. A systematic survey of charging events and the environment in which they occur was made using the DMSP F 6 and 7 precipitating ion and electron detectors, the SSIE thermal plasma probes, and the SSM(F7 only) vector magnetometer. The charging events of November 26, 1983, are analyzed in detail since they occurred on both satellites. Critical levels of number flux and average energy for the precipitating electrons, and the threshold density of the thermal ionospheric ions are defined for different levels of spacecraft charging.

26421 **(AD-A—162159/8/XAB) Physics of natural and hf-induced ionospheric disturbances and their effects on radio communication. Final report, 1 February 1983-30 June 1985.** (Regis Coll., Weston, MA (USA). Research Center). 30 Jun 1985. 86p. NTIS, PC A05/MF A01.

A theoretical study is reported of ionospheric disturbances caused by either natural or man-made processes. Thirteen papers published in either technical journals or conference proceedings are compiled in this report. These papers discuss (1) the identification of the sources of free energy, the optimum conditions for plasma instabilities as the courses of naturally occurring ionospheric irregularities, and (2) the nonlinear effects leading to the h-f ionospheric disturbances such as lower-hybrid waves, upper-hybrid waves, ionospheric irregularities, and geomagnetic field fluctuations.

26422 **(AD-A—162502/9/XAB) Use of the McIlwain l-parameter to estimate cosmic ray vertical cutoff rigidities for different epochs of the geomagnetic field.** Shea, M.A.; Smart, D.F.; Gentile, L.C. (Air Force Geophysics Lab., Hanscom AFB, MA (USA)). 1985. 6p. (AFGL-TR—85-0309). NTIS, PC A02/MF A01.

A useful relationship employing the McIlwain L-parameter to estimate vertical cutoff rigidities has been derived for the twenty-five year period 1955-1980.

26423 **(AD-A—162513/6/XAB) Magnetohydrodynamic modelling of interplanetary disturbances between the sun and earth.** Dryer, M.; Wu, S.T.; Gislason, G.; Han, S.M.; Smith, Z.K. (Air Force Geophysics Lab., Hanscom AFB, MA (USA)). 1984. 24p. (AFGL-TR—85-0305). NTIS, PC A02/MF A01.

A time-dependent, nonplanar, two-dimensional magnetohydrodynamic computer model used to simulate a series, separately examined, of solar flare-generated shock waves and their subsequent disturbances in interplanetary space between the Sun and the Earth's magnetosphere. The canonical or ansatz series of shock waves include initial velocities near the Sun over the range 500 to 3500 km/s. The ambient solar wind, through which they propagate, is taken to be a steady-state homogeneous plasma (that is independent of heliolongitude) with a representative set of plasma and magnetic field parameters. Complete sets of solar wind plasma and magnetic field parameters are presented and discussed. Particular attention is addressed to the MHD model's ability to address fundamental operational questions vis-a-vis the long-range forecasting of geomagnetic disturbances. These questions are: (i) will a disturbances (such as the present canonical series of solar flare shock waves) produce a magnetospheric and ionospheric disturbance, and, if so, (ii) when will it start, (iii) how severe will it be, and (iv) how long will it last. The model's output is used to compute various solar wind indices of current interest as a demonstration of the model's potential for providing answers to these questions.

26424 **(AD-A—162603/5/XAB) Ionospheric modification with obliquely incident waves: electron heating and parametric instabilities. Interim report, December 1983-March 1985.** Field, E.C.; Warber, C.R. (Pacific-Sierra Research Corp., Los Angeles, CA (USA)). Oct 1985. 45p. (PSR—1506). NTIS, PC A03/MF A01.

Nearly all ionospheric modification experiments have been carried out with the modifying wave at vertical incidence. For many applications, however, the modifying wave would probably be at oblique incidence. This report identifies nonlinear phenomena that could be caused by obliquely incident modifying waves. It concentrates on phenomena that might enhance or degrade the performance of high frequency (HF) radar or communications systems. The nonlinear processes that lead to ionospheric modification divide naturally into two categories: (1) ohmic heating, which alters temperature and hence, reaction rates, collision frequencies, and particle densities, and (2) generation of parametric instabilities, which causes a myriad of phenomena. As the incidence angle is increased, heating is affected by two competing trends. It is weakened by the increased path length, but is strengthened near caustics. A transmitter with a power-gain product on the order of 10 MW can launch and oblique wave strong enough to produce electric fields of several tenths of a volt per meter or more in the ionos-

phere. Such fields produce substantial temperature increases, which are initially concentrated near the caustics, but spread via heat conduction.

26425 **(AD-A—162754/6/XAB) High frequency radar studies of the very-high-latitude ionosphere. Final report, 15 February 1983-30 September 1985.** Greenwald, R.A. (Johns Hopkins Univ., Laurel, MD (USA). Dept. of Space). 30 Sep 1985. 57p. NTIS, PC A04/MF A01.

Operation of the Goose Bay radar began on October 11, 1983. Since that time, collaborative measurements have been made with both the Sondre Stromfjord and Millstone Hill incoherent scatter radars, with the HILAT satellite, and with the Air Force Geophysics Laboratory Airborne Geophysical Observatory. In addition, an extensive set of noncollaborative measurements have been obtained. From this base of observation, several papers have been written and submitted for publication and several studies have been initiated but not, as yet, reached the publication stage. These efforts include an examination of high-latitude F-region irregularties in the afternoon and late-evening local-time sectors, an attempt to use the HF radar data to study the two-dimensional structure of irregularity drifts, a detailed study of plasma conditions and irregularity characteristics in the vicinity of the dayside cleft, attempts to compare E- and F-region irregularity drifts with plasma-drift measurements obtained with the Sondre Stromfjord and Millstone Hill incoherent scatter radars, and some preliminary observations of seasonal depencences in the diurnal formation of high latitude F-region irregularities.

26426 **(AD-A—162930/2/XAB) Ground-based atmospheric infrared and visible emission measurements. Report for 15 July 1983-14 June 1985.** Baker, D.J.; Steed, A.J.; Ware, G.A.; Offermann, D.; Lange, G. (Utah State Univ., Logan (USA)). 1985. 15p. NTIS, PC A02/MF A01.

This reprint describes Ground-based measurements of night-sky near-infrared and visible emissions made at the Andenes, Norway, and Kiruna, Sweden, rocket launch sites during the Energy Budget Campaign of 1980. Optical measurements were made using visible and infrared photometers, a Michelson interferometer and a grating spectrometer. The specific aim of the experiments reported in the present paper was to investigate the relationships between the optical emissions from upper atmospheric hydroxyl (OH) and molecular oxygen (O2)and the magnetic activity in the auroral zone. Other airglow emissions, including the O and N2(+) species, wee monitored photometrically for diagnostic purposes. Furthermore, the ground-based optical instruments were used to support rocket-borne experiments launched in salvoes during the campaign. Observations were provided before and after the launches of the rocket payloads. Comparisons between upper atomospheric temperatures derived from airglow emissions and those obtained from in situ rocket probes were sought.

26427 **(AD-A—163025/0/XAB) Modification of the ionospheric electron-velocity distribution function due to resonant absorption of hf waves.** Morales, G.J.; Maggs, J.E. (California Univ., Los Angeles (USA). Center for Plasma Physics and Fusion Engineering). Dec 1985. 44p. (PPG—913). NTIS, PC A03/MF A01.

The nonlinear modification of the electron distribution function caused by the interaction with a resonant electrostatic field is studied analytically using a perturbation analysis. This interaction produces tail heating, and for a range of parameter values, can form a bump in the distribution, which leads to emission of secondary waves. These results are applied to the ionosphere's F and upper E regions in the context of ionospheric modification experiments using ground-based powerful HF transmitters. Analogies between these results and experimental measurements are discussed. The purpose of this work is to calculate the modification in the electron velocity distribution function resulting from the resonant excitation of electrostatic oscillations in the ionosphere. It is hoped that the analytic results may help illuminate some of the various experimentally observed phenomena, and perhaps suggest new experiments which would probe the nature of the electron acceleration mechanisms.

26428 **(AD-A—163048/2/XAB) Plasma wave instrument on the AMPTE/IRM (Active Magnetospheric Particle Tracing Explorers/Ion Release Module) spacecraft. Annual letter report, 1 December 1984-30 November 1985.** (Iowa Univ., Iowa City (USA). Dept. of Physics and Astronomy). 30 Nov 1985. 5p. NTIS, PC A02/MF A01.

The primary purposes of the Active Magnetospheric Particle Tracing Explorers (AMPTE) program were (1) to carry out the release and monitoring of lithium and barium ions in the solar wind and within the distant magnetosphere in order to study the access of solar-wind ions to the magnetosphere, the convective-diffusive transport and energization of magnetospheric particles, and the instabilities and wave-particle interactions associated with the releases and the subsequent evolution of the injected clouds, and (2) to generate massive releases of barium in the dawn and dusk magnetosheath in order to create visible artificial comets in the flowing solar-wind plasma within which studies of diamagnetic effects, ionization, momentum exchange, ion transport, and visible phenomena could be made.

26429 **(AD-A—163306/4/XAB) Radiation of long electromagnetic waves by a modulated electron beam in the ionosphere. Final report, December 1983-August 1985.** Field, E.C.; Johnson, L.E. (Pacific-Sierra Research Corp., Los Angeles, CA (USA)). Dec 1985. 45p. (PSR—1566). NTIS, PC A03/MF A01.

Pulsed electron beams in the ionosphere radiate electromagnetic energy and, therefore, might work as wireless virtual antennas. Such virtual antennas would be most useful at low frequencies because small or moderate-size wire antennas work well at high frequencies. Natural beams radiate energy that propagates down through the ionosphere, but no experiment has used a man-made electron beam to produce radiation at the modulation frequency or its harmonics, and detected that radiation on the ground. This report addresses the feasibility of such an experiment, and suggests preferred configurations. Motivated by communications applications, which require good time availability, it considers only phenomena, such as the triggering plasma of instabilities or guidance in transient ionospheric ducts.

26430 **(LA-UR—86-961) Neutral sheet crossings in the distant magnetotail.** Heikkila, W.J.; Slavin, J.A.; Smith, E.J.; Baker, D.N.; Zwickl, R.D. (Texas Univ., Dallas (USA); Jet Propulsion Lab., Pasadena, CA (USA); Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 38p. (CONF-8510254—5). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86008742.

From Chapman conference on magnetotail physics; Laurel, MD, USA (28 Oct 1985).

We have analyzed the magnetic field data from ISEE-3 in the distant magnetotail for 18 crossings of the cross-tail current sheet (or so-called natural sheet) to determine the direction of the normal component B/sub z/. The crossings occurred near the middle of the aberrated magnetotail ($0 < y < 30$ R/sub e, $-10 < z < 5$) in GSM coordinates, at a distance of about 220 R/sub e/, January 28 to February 12, 1983; in each case the plasma flow velocity was tailward. In 2 cases we found B/sub z/ negative (southward), as would be required with a magnetic neutral line (reconnection line) earthward of the spacecraft. In 12 cases B/sub z/ was clearly northward (B/sub z/ > 0.4 nT), consistent with closed field lines connected to the earth. In 3 cases B/sub z/ was very close to zero; in several instances there was structure in B/sub y/, suggesting localized currents with x or z directions. One may have been a magnetopause crossing. The strong preponderance of northward B/sub z/ favors a model of the magnetotail which is dominated by boundary layer plasma, flowing tailward on closed magnetic field lines, which requires the existence of an electric field in the sense from dusk to dawn. 37 refs., 15 figs., 1 tab.

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REFER ALSO TO CITATION(S) 25864, 25877, 26055, 26464, 26608

26431 (AD-A—161960/0/XAB) Interpretation of the O_2 auger electron spectrum. Technical report. Ramaker, D.E. (George Washington Univ., Washington, DC (USA). Dept. of Chemistry). Oct 1985. 23p. (TR—20). NTIS MF A01.

The Auger electron spectrum of O_2 is interpreted by comparing with other spectra, such as photoelectron spectrum, the electron-impact mass spectrum, and the double charge-transfer spectrum. Each of these four spectra obeys their own selection rules; the difference in the selection rules plays a key role in the interpretation. Auger decays following a core shake-up excitation are identified for the first time. Many of the previous assignments are revised.

26432 (AD-A—162357/8/XAB) Comparison of quantum, classical, and semiclassical descriptions of a model, collinear, inelastic collision of two diatomic molecules. Memorandum report. Page, M.; Oran, E.S.; Boris, J.P.; Miller, D.; Wyatt, R.E. (Naval Research Lab., Washington, DC (USA)). 13 Dec 1985. 47p. (NRL-MR—5700). NTIS, PC A03/MF A01.

The collinear dynamics of a model diatom-diatom system is investigated. The collision partners are harmonic oscillators for which the masses and force constants are chosen to correspond to those of the nitrogen and oxygen molecules. The interaction between the molecules arises from a Lennard-Jones 6-12 potential acting between the inside atoms in the collinear system. Quantum-mechanical close coupled calculations are performed for several collision energies ranging from 1.0 ev to 2.25 ev. The state-to-state transition probabilities which are extracted from these calculations are then used as a benchmark for comparison. Semiclassical calculations are performed within the framework of a classical path approximation. A simple scheme to modify the classical path to reflect energy exchange between the collision coordinate and the internal degrees of freedom is found to improve the results. On the whole, the agreement between the semiclassical and the quantum mechanical results is surprisingly good. The classical trajectory calculations correctly display many of the qualitative features of the collisions but the numerical agreement is not as close. Unexpectedly, the classical results do not appear to be improving as the collision energy is increased.

26433 (AD-A—162986/4/XAB) Theory of excitation transfer between Rydberg atoms. Saha, H.P.; George, T.F. (Rochester Univ., NY (USA). Dept. of Chemistry and Physics). May 1985. 15p. NTIS, PC A02/MF A01.

A quantal theory of laser-induced Penning and associative ionization is extended to field-free excitation transfer processes between Rydberg atoms, where an appropriate local potential approximation is applied. Formulae for total and differential cross sections are presented. Cross section formulae which are specific to a semiclassical description of the heavy-particle motion are also constructed.

26434 (AD-A—163011/0/XAB) Neutralization and excitation in low-energy ion-surface collisions. Lee, H.W.; George, T.F. (Rochester Univ., NY (USA). Dept. of Chemistry and Physics). Aug 1985. 20p. NTIS, PC A02/MF A01.

A model is presented which describes neutralization and excitation occurring in low-energy ion-surface collisions. Important processes that determine experimentally measurable quantities such as charged fraction f+ and photon yield γ are assumed to be Auger neutralization, electronic excitation and radiationless deexcitation. The model yields f+ and γ in good agreement with experimental data, although log f+ and log γ are found to exhibit nonlinear dependence on the inverse velocity of the incident ion beam.

26435 (AD-A—163065/6/XAB) Dissociative electron attachment to rovibrationally excited molecules. Annual technical report no. 1, 1 August 1984-30 September 1985. Wadehra, J.M. (Wayne State Univ., Detroit, MI (USA). Dept. of Physics). 30 Sep 1985. 11p. NTIS, PC A02/MF A01.

The aim of this project is to investigate the dependence of the cross sections for dissociative electron attachment to a molecule on the initial rovibrational state of the molecule. An enhancement of the cross section results in the enhancement of the rate of production of negative ion beams. Preliminary investigations reveal that for lithium dimers, Li_2, the peak attachment cross sections can increase by almost an order of magnitude if the molecule is initially vibrationally excited to the v = 1 level. Excitation to higher vibrational levels would result in further enhancement of the attachment rates. As part of present investigations, the cross sections for vibrational excitation of various molecules, using both resonant and non-resonant mechanisms is calculated.

26436 (AD-A—163205/8/XAB) Analysis of experimental data for neutralization of low-energy ions at a surface. Interim technical report. George, T.F. (State Univ. of New York, Buffalo (USA). Dept. of Chemistry). Jan 1986. 48p. (TR—3). NTIS, PC A03/MF A01.

When low-energy ions are incident on a solid surface, a large fraction is neutralized via on Auger or resonance process. Some useful information on details of the neutralization process can be obtained by studying the ion fraction of backscattered particles. An accurate evaluation of the characteristic velocity, is expected to be particularly useful. In this paper we give a theoretical analysis is presented of experimental ion-yield data that exist in the literature. It is shown that a successful interpretation of the ion-yield data can be made by taking into account the variation of the characteristic velocity with respect to the incident ion energy.

26437 (BNL—37051) Effects of surface microroughness in ellipsometry. Church, E.L.; Zavada, J.M. (Army Armament Research and Development Command, Dover, NJ (USA)). Dec 1985. Contract AC02-76CH00016. 30p. (CONF-761041—3; CONF-750993—4). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86008014.

From Workshop on optical fabrication and testing; Tucson, AZ, USA (18 Oct 1976).

We calculate the effects of surface roughness on the ellipsometric angles using plans-wave Rayleigh-Rice vector scattering theory. In the perturbation limit - RMS roughness height << incident wavelength - these effects can be written in terms of weighted intergals over the power spectral density of the surface roughness. We present results in this limit for surfaces with arbitrary optical index and arbitrary two-dimensional roughness distributions, and then illustrate and assess them by considering four distinct limits: (1) Deterministic roughness in the form of periodic corrugations. (2) Statistical roughness with large transverse correlation lengths relative to the incident wavelength. (3) Statistical roughness with small transverse correlation lenghts. (4) Highly reflecting surface materials. 10 refs.

26438 (CBPF-NF—014/85) Magnetic order of singlet-singlet ions coupled to conduction electrons: band structure effects. Palermo, L.; Silva, X.A. da. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1985. 15p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701483.

The onset of magnetic order of a system consisting of conduction electrons interacting with localized f-electrons having only two singlet levels is analysed. The effects of band structure, crystal field and exchange parameters are deduced from a parametric study of the model. It is suggested that the combined role of these effects may be of importance in explaining drastic differences in the magnetic properties of light rare-earth intermetallics.

26439 (CBPF-NF—038/85) Structure of the spin polarization spectrum of secondary electrons emitted from nickel. Helman, J.S. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1985. 12p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701484.

The main features of the structure observed in the energy resolved spin polarization of secondary electrons emitted from Ni are interpreted in terms of surface and bulk plasmon assisted emission. The model also predicts a measurable shift of the main polarization peak of about 0.3 eV to lower energies as the temperature is raised from room temperature to closely below the Curie temperature.

26440 (DOE/ER/13440—T1) Hyperspherical coordinate theory of two-electron processes. Technical progress report and future plans. Macek, J.; Starace, A.F. (Nebraska Univ., Lincoln (USA). Dept. of Physics and Astronomy). 1985. Contract FG02-85ER13440. 7p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86008860.

The main focus of our project is electron correlation in atoms using methods based on hyperspherical coordinates. Our aim is primarily to lay the ground work for state-of-the-art calculations employing hyperspherical coordinates. In addition, we intend to make applications to specific atomic collision processes in those cases where a hyperspherical coordinate point of view can make a significant contribution to our understanding of the physical mechanisms involved. Brief descriptions are given for the following investigations: (1) asymptotic solution of the adiabatic hyperspherical equation, (2) pseudo-states in the adiabatic approximation, (3) determination of target average excitation energy from doubly differential electron-detachment cross section measurements, and (4) contribution of H^* (n = 2 states to H^--He detachment collision cross sections. 9 refs., 1 figs.

26441 (ENEA-RT-TIB—84-36) Comparison of universal potentials for atomic collisions in solids. Cupini, E.; Ventura, A. (ENEA, Rome (Italy)). 1984. 12p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701498.

Elastic collisions in solid of ions having kinetic energy greater than about ten eV are fairly well described by the binary collision approximation, where screened coulomb potentials are often used. The aim of the present work is to compare calculations based on the Moliere potential and on the more realistic Biersack-Ziegler potential for atomic collisions in solids having an atomic number between Z=6 and Z=79 with experimental data. A reasonable agreement with data can be obtained, in general, by means of both potentials provided that the screening lenght is suitably modified in the Moliere case, while no parameter adjustment is needed in the Biersack-Ziegler potential.

26442 (INER—0560) K-shell x-ray production by molecular ion beams D^+, D_2^+ and D_3^+. Cheng, K.C.; Wu, P.T.; Chih, C.Y. (Institute of Nuclear Energy Research, Lung-Tan (Taiwan)). Oct 1984. 60p. NTIS (US Sales Only), PC A04/MF A01. File Number DE86901033.

The 7 MV Van de Graaff accelerator at the Institute of Nuclear Energy research was used to produce molecular ion beams, in order to investigate the K-shell x-ray production in metallic atoms. The angular dependence of the ionization probabilities for K-shell electrons in Ni atoms was measured with three species of molecular deuterium beams, including 2 MeV D^+, 4 MeV D_2^+ and 6 MeV D_3^+. The experimental results show that ratios of ionization probabilities for molecular beams D_2^+ and D_3^+ to that of atomic beam D^+ increase at large scattering angles, similar to the results obtained by using molecular hydrogen beams. Explanations based on various interaction mechanisms between the incoming molecular ion and the target atom are described. 11 refs., 32 figs.

26443 (LBL—20065) Basic considerations on surface optical nonlinearities. Guyot-Sionnest, P.; Chen, W.; Shen, Y.R. (Lawrence Berkeley Lab., CA (USA)). Jan 1986. Contract AC03-76SF00098. 3p. (CONF-851208—4). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86008378.

From 8. international conference on lasers; Las Vegas, NV, USA (2 Dec 1985).

The origins of the surface nonlinearity in surface second harmonic generation are discussed. It is shown that this second-order nonlinear optical process is characterized by a surface nonlinear susceptibility tensor containing both local and nonlocal contributions.

26444 (PB—86-165446/XAB) Atomic energy levels of the iron-period elements: potassium through nickel. Sugar, J.; Corliss, C. (American Chemical Society, Washington, DC). 1985. 680p. NTIS, PC A99/MF A01.

Experimentally derived energy levels of the elements from potassium to nickel in all stages of ionization are critically compiled. The data for each level include its position in /cm (relative to the ground state), configuration, term designation, J-value, and, where available, the g-value and two leading percentages of the eigenvector composition in the most appropriate coupling scheme. For the He I and H I isoelectronic sequences, calculated level positions are given because they are considered more accurate than the measurements presently available. Ionization energies for each ion are derived either from Rydberg series, extrapolation, or calculation. Complete references are given for the compiled data.

26445 (PNL-SA—11871) Isotopic splitting of the Sr 5 $1S_0$ to 5 $1P_1$ transition. Morrey, J.R.; Bushaw, B.A.; Whitaker, T.J.; Kaye, J.H.; Warner, R.A. (Pacific Northwest Labs., Richland, WA (USA)). Nov 1983. Contract AC06-76RL01830. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86007783.

The purpose of this letter is to report some new measurements on the isotopic fine structure of the 5 $^1S_0 \rightarrow 5\ ^1P_1$ transition of a normal isotopic mixture of strontium. We have measured the doppler-free resonance fluorescence of the line nominally at 460.87 nm with a single frequency dye laser. 5 refs., 2 figs.

26446 (SAND—85-2692C) Measurement of oscillator strengths of Hg by four-wave mixing. Smith, A.V.; Alford, W.J. (Sandia National Labs., Albuquerque, NM (USA)). 1986. Contract AC04-76DP00789. 7p. (CONF-860316—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86008775.

From Topical meeting on short wavelength coherent radiation; Monterey, CA, USA (24 Mar 1986).

We have developed techniques for accurate determination of oscillator strengths based on four-wave mixing. Using both refractive index matching and the frequency dependence of the nonlinear susceptibility, we have obtained about 50 oscillator strengths important for four-wave mixing in Hg. 4 refs., 4 figs., 1 tab.

26447 (SAND—86-0013C) Light scattering from oxygen in ZnTe. Hjalmarson, H.P.; Jones, E.D.; Norris, C.B. (Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 4p. (CONF-851185—16). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86007820.

From International laser science conference; Dallas, TX, USA (18 Nov 1985).

Resonant light scattering experiments and calculations have been performed on substitutional oxygen impurities in ZnTe. 8 refs., 2 figs.

26448 (UCRL—93471-Rev.1) High-resolution absorption spectrum of the $6^1S_0 \rightarrow 6^3P_1$ transition in mercury with a cw dye laser. Revision 1. Crane, J.K.; Erbert, G.V.; Mostek, S.D.; Kerlin, R.C.; Paisner, J.A. (Lawrence Livermore National Lab., CA (USA)). 1985. Contract W-7405-ENG-48. 4p. (CONF-851185—2-Rev.1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86008144.

From International laser science conference; Dallas, TX, USA (18 Nov 1985).

Using a stabilized single-frequency commercial dye laser and an external cavity doubling crystal, we have measured the isotope shifts of mercury for the $6^1S_0 \rightarrow 6^3P_1$ transition with an accuracy of 4 MHz. We describe the method for generating single-frequency light at 2537 A and compare the results of our measurements of the isotope shifts with previous work. 4 refs., 1 fig., 1 tab.

26449 (UTNL-R—0145) New techniques of positron annihilation. (Tokyo Univ., Tokai, Ibaraki (Japan). Nuclear Engineering Research Lab.). Feb 1983. 69p. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. File Number DE86701497.

Studies on new techniques of positron annihilation and its application to various fields are presented. First, production of slow positron and its characteristic features are described. The slow positron can be obtained from radioisotopes by using a positron moderator, proton beam bombardment on a boron target, and pair production by using an electron linear accelerator. Bright enhancement of the slow positron beam is studied. Polarized positron beam can be used for the study of the momentum distribution of an electron

in ferromagnetic substances. Production of polarized positrons and measurements of polarization are discussed. Various phases of interaction between slow positrons and atoms (or molecules) are described. A comparative study of electron scavenging effects on luminescence and on positronium formation in cyclohexane is presented. The positron annihilation phenomena are applicable for the surface study. The microscopic information on the surface of porous material may be obtained. The slow positrons are also useful for the surface study. Production and application of slow muon (positive and negative) are presented in this report.

26450 Secondary electron yield and Auger electron spectroscopy measurements on oxides, carbide, and nitride of niobium. Garwin, E.L.; Hoyt, E.W.; Kirby, R.E.; Momose, T. (Stanford Linear Accelerator Center, Stanford University, Stanford, California 94305). *Journal of Applied Physics;* **59**: No. 9, 3245-3250(1 May 1986). Contract AC03-76SF00515.

Secondary electron yield measurements before and after Ar ion sputtercleaning were made on Nb and Nb compounds of interest for rf superconductingcavities. Total secondary electron yields (σ) for primary energies 20—1500 eV were measured for solid Nb (σ/sub max/ = 1.3 at 300 eV), anodized Nb_2O_5 (σ/sub max/ = 1.2 at 300 eV), and powders of Nb(σ/sub max/ = 1.0 at 400 eV), NbO (σ/sub max/ = 0.9 at 400 eV), NbO_2 (σ/sub max/ = 1.0 at 400 eV), Nb_2O_5 (σ/sub max/ = 0.95 at 400 eV), NbC(σ/sub max/ = 0.8 at 400 eV), and NbN (σ/sub max/ = 0.8 at 500 eV). Determinations were made for Auger elemental sensitivities, and the relationship between Auger peak heights and oxide stoichiometry is discussed. The sputter etch rate of anodized Nb_2O_5 was measured by depth profiling anodic coatings of known thickness.

26451 Non-Franck—Condon $2\sigma p1$/sub u/ vibrational distributions in N^+_2. An interchannel-coupled shape resonance observed by dispersed fluorescence. Poliakoff, E.D.; Ho, M.; Leroi, G.E.; White, M.G. (Department of Chemistry, Boston University, Boston, Massachusetts 02215). *Journal of Chemical Physics;* **84**: No. 9, 4779-4785(1 May 1986).

We report evidence for a molecular interchannel-coupled shape resonance in N_2 photoionization, observable in the vibrational branching ratios for the $N^+_2(B\ ^2\Sigma^+$/sub u/) state. The vibrational branching ratios for the $N^+_2(B\ ^2\Sigma^+$/sub u/) state are determined from vibrationally resolved dispersed fluorescence measurements on the $N^+_2(B\ ^2\Sigma^+$/sub u/$\rightarrow X\ ^2\Sigma^+$/sub g/) band system. The results demonstrate that the partial cross section for the $N^+_2(B\ ^2\Sigma^+$/sub u/,v' = 1) level is selectively enhanced in the photon energy range 28 <hν/sub exc/<30 eV. A shape resonance occurs in this range for the 3σ/sub g/$\rightarrow\epsilon\sigma$/sub u/ channel, and the observed enhancement is attributed to coupling between this channel and the 2σ/sub u/$\rightarrow\epsilon\sigma$/sub g/ channel. Vibrational branching ratio curves for the excited state ion also show a pronounced peak at hν/sub exc/ = 22 eV, which shifts for the curves that sample the v' = 1 and v' = 2 levels of the ion, suggesting a few interpretations. The utility of coupling monochromatized fluorescence detection with synchrotron radiation excitation for extracting relative partial photoionization cross sections is demonstrated for the first time.

26452 Electron affinity of fluorine: A quantum Monte Carlo study. Barnett, R.N.; Reynolds, P.J.; Lester W.A. Jr. (Materials and Molecular Research Division, Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Journal of Chemical Physics;* **84**: No. 9, 4992-4996(1 May 1986). Contract AC03-76SF00098.

The total nonrelativistic energies of the fluorine atom and its negative ion are calculated using the fixed-node quantum Monte Carlo (QMC) method. Over 90% of the correlation energy is obtained for both the neutral and the anion. Subtracting these energies yields an electron affinity of 3.45 +- 0.11 eV, in excellent agreement with the recommended experimental value of 3.40 eV. The observed dependence of our Monte Carlo energies on the time step is discussed within the short-time QMC formalism. As in previous QMC studies in this series, only a single determinant, constructed with a small (double-zeta) basis set, multiplied by simple functions of electron—electron and electron—nuclear separation, is required as an importance function.

26453 Classical models for electronic degrees of freedom: The second-quantized many-electron Hamiltonian. Miller, W.H.; White, K.A. (Department of Chemistry, University of California, and Materials and Molecular Research Division, Lawrence Berkeley Laboratory, Berkeley, California 94720). *Journal of Chemical Physics;* **84**: No. 9, 5059-5066(1 May 1986).

A classical Hamiltonian is constructed which corresponds to the general second-quantized Hamiltonian operator for a many-electron system. This classical electronic Hamiltonian properly accounts for the fermion character of electrons (i.e., the anticommutivity of the electron creation and annihilation operators). By having a classical description of the electronic degrees of freedom one is able to incorporate electronically nonadiabatic effects into a classical trajectory simulation of nuclear motion in a dynamically consistent way. Several applications are described which illustrate the nature of the model. It can be viewed, for example, as a generalization of an earlier classical valence bond model (based on a Heisenberg—Van Vleck spin Hamiltonian), the generalization being to include the effects of ionic as well as covalent configurations in the description. The present model, therefore, is able to describe charge transfer aspects of the electronic degrees of freedom.

26454 Electric-field-induced mixing of high Rydberg-state levels in dielectronic recombination: Mg^{1+} and Ca^{1+} target ions. LaGattuta, K.; Nasser, I.; Hahn, Y. (Department of Physics, University of Connecticut, Storrs, Connecticut 06268). *Physical Review [Section] A: General Physics;* **33**: No. 4, 2782-2785(Apr 1986).

The effect on the dielectronic recombination cross section of electric-field-induced mixing of high Rydberg-state (HRS) levels is determined, for both Mg^+ and Ca^+ target ions. After diagonalizing the energy matrix, σ/sub n//sup DR/ is calculated in the isolated resonance approximation as a function of n, the principal quantum number of the HRS electron. From this result, both the total cross section, σ/sup DR/equivalentsummation σ/sub n//sup DR/, and the total cross section integrated over energy, Ω/sup DR/equivalent$\int$ de/sub c/ σ/sup DR/, are obtained. The agreement between theory and experiment for Ω/sup DR/ is very good in the case of Mg^+, while roughly a factor of 2 discrepancy still exists for Ca^+.

26455 Quantitative determination of the fraction of Rydberg electrons in a convoy-electron cusp. Engar, P.; Breinig, M.; DeSerio, R.; Gonzalez-Lepera, C.E.; Sellin, I.A. (Physics Department, University of Tennessee, Knoxville, Tennessee 37996; Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831). *Physical Review [Section] A: General Physics;* **33**: No. 3, 2096-2098(Mar 1986). Contract AC05-84OR21400.

Experiments are described which show that the fraction of electrons from high Rydberg states which contaminate the traditionally measured convoy-electron spectrum for fast oxygen ions emerging from thin carbon foils is small (<3%). Field ionization of the high Rydberg states is also found to be approximately independent of the direction of the field, although quantum beats indicate coherent Rydberg-state excitation.

26456 Coincidence experiment concerning the origin of convoy electrons produced by swift deuterium beams traversing carbon foils. Menendez, M.G.; Duncan, M.M.; Berry, S.D.; Sellin, I.A.; Meckbach, W.; Focke, P.; Nemirovsky, I.B.E. (Department of Physics and Astronomy, University of Georgia, Athens, Georgia 30602). *Physical Review [Section] A: General Physics;* **33**: No. 3, 2160-2163(Mar 1986). Contract AC05-84OR21400.

We have measured convoy electrons produced by the passage of deuterium particles through thin carbon foils in coincidence with emerging particles in both charge states, D^+ and D^0. The energy spectrum of electrons coincident with emerging D^+ ions exhibits the characteristic convoy-electron cusp shape centered about the projectile velocity. The energy spectrum of electrons coincident with emerging D^0 particles also exhibits a peak at the projectile velocity, but its shape appears to be qualitatively different from the e-D^+ coincidence spectrum. We suggest that e-D^0 coincidences are the result of neutralization of D^+ particles (accompanied by convoy

electrons) between the sites of congies and agree very well with recent measurements, in the energy range where channel coupling and autoionizing transitions are not important. Comparison is also made with a calculation carried out within the local-density random-phase approximation.

26457 **High efficiency ionizer using a hollow cathode discharge plasma.** Alessi, J.G.; Prelec, K. (Brookhaven National Laboratory, Associated Universities, Inc., Upton, New York 11973). *AIP (American Institute of Physics) Conference Proceedings;* **131**: No. 1, 18-24(30 Jul 1985).

A proposal for an ionizer using a hollow cathode discharge plasma is described. Ionization is via the very high current density electron beam component in the plasma, as well as from charge exchange with plasma ions. Extraction of a He^+ current corresponding to approximately 50% of the incoming atomic beam flux should be possible.

26458 **Dynamics of resonant states.** Fano, U. (Univ. of Chicago, Chicago, IL). pp 5-22 of Atomic physics 8. Lindgren, I.; Rosen, A.; Svanberg, S. New York, NY; Plenum Press (1983). (CONF-820868—).

From International conference on atomic physics; Gothenburg, Sweden (2 Aug 1982).

This chapter examines why the particles of many resonances appear to be localized in a region of configuration space free of obvious confining barriers. Discusses prototype phenomena; evidence on the diamagnetism of Rydberg states; and wave propagation astride the ridge. Investigates a wave function along a ridge because the theory of resonant Rydberg states in a magnetic field remains restricted to a perturbative treatment. Concludes that the numerous contributions to the study of resonant states summarized in this report provide a composite picture which is consistent but fragmented.

26459 **A time-dependent local density approximation of atomic photoionization.** Zangwill, A. (Brookhaven National Laboratory, Upton, NY). pp 339-353 of Atomic physics 8. Lindgren, I.; Rosen, A.; Svanberg, S. New York, NY; Plenum Press (1983). (CONF-820868—).

From International conference on atomic physics; Gothenburg, Sweden (2 Aug 1982).

This chapter reviews time-dependent local density approximation (TDLDA), illustrates its scope and limitations and compares it to the more familiar Hartree-Fock (HF) based methods. Demonstrates that the photoabsorption of xenon in the 4d is inadequately described by single particle theory. Points out features of the TDLDA as revealed in the total photoabsorption cross section of krypton. Shows the success of the TDLDA for the barium total photoabsorption as mirrored in the resonant behavior of the valence level partial photoemission cross sections near the 4d threshold. Suggests that additional research is necessary to understand the apparent superiority of the TDLDA to random phase approximation with exchange (RPAE).

26460 **Atomic collisions in the high energy regime.** Datz, S. (Oak Ridge National Laboratory, Oak Ridge, TN). pp 369-394 of Atomic physics 8. Lindgren, I.; Rosen, A.; Svanberg, S. New York, NY; Plenum Press (1983). (CONF-820868—).

From International conference on atomic physics; Gothenburg, Sweden (2 Aug 1982).

This chapter examines the relation of Coulomb ionization to the molecular orbital (MO) picture of the united atom and the application of these results to the structure of K shell in super-heavy atomic systems. Discusses recent results on electron transfer into discrete states and charge transfer events which involve more than one electron (e.g., capture to continuum and "transfer ionization"). Describes the recent observation of radiation arising from bound state transitions in one and two dimensional "atoms" and "molecules" formed when high energy electrons are injected into a crystal along directions close to atomic rows and planes. Investigates K shell ionization in high Z systems; impact parameter dependence of K to K charge transfer; and channeling radiation (atomic and molecular physics in one and two dimensions).

26461 **Electron impact excitation of ions.** Crandall, D.H. (Physics Div., ORNL, Oak Ridge, TN). pp 201-238 of Physics of ion-ion and electron-ion collisions. Vol. 83. Brouillard, F.; McGowan, J.W. New York, NY; Plenum Publishing Corp. (1983). (CONF-810958—).

From NATO advanced study summer institute on the physics of ion-ion and electron-ion collisions; Baddeck, Nova Scotia, Canada (13 Sep 1981).

In researching electron impact excitation of ions, prediction of cross-section rates is still uncertain. This paper reviews electron-ion beam experiments. Theory is reviewed, then energy levels of the electron and He-like atom, and some of the transitions important in electron impact excitation studied. Close-coupling (coupled state) theory is treated. The distorted wave and Coulomb Born Approximations are applied. Experimental techniques are then reviewed. The plasma-based rate measurements are studied. Electron-ion beam experiments are represented schematically. The optical detection system (to observe photon emissions of electron and ion–collisions) is detailed. The parameters for the best experiments are determined. Finally, simple systems (for He+) and complex systems (for heavy ions), the experiments, and theoretical attention given them, are surveyed.

26462 **Theory of electron-ion collisions.** Kim, Y.-K. (Argonne National Laboratory, Argonne, IL). pp 101-165 of Physics of ion-ion and electron-ion collisions. Vol. 83. Brouillard, F.; McGowan, J.W. New York, NY; Plenum Publishing Corp. (1983). (CONF-810958—).

From NATO advanced study summer institute on the physics of ion-ion and electron-ion collisions; Baddeck, Nova Scotia, Canada (13 Sep 1981).

This lengthy treatment of the collision of atoms studies electron-atom collision, instead of ion-atom, because the former are better understood, and comparison with ions will help understanding ions. A series of lectures is outlined as follows. Theory of Fast Collision: The Born Approximation is studied first. The basic formulas--plane wave Born (PWBA), Coulomb Born Approximation (CBA), Distorted wave Born approximation (DWBA) are investigated, and generalized. Integrated crosssections in PWBA, the Fano plot, and line strength, and comparison of PWBA, CBA, and DWBA in discrete excitation concludes the study of the Born Approximation. Ionization by electron impact is studied next. Cross sections, angle distribution, and energy distribution of secondary electrons are among the points touched on in electron impact study. Total ionization cross-section is then treated for fast, intermediate, and low incident energies. Relativistic kinematics and electron correlation studies follow. The theory of slow collisions, second Born, Glauber, and close coupling approximations are considered under this heading.

26463 **Electron structure of molecules with very heavy atoms using effective core potentials.** Pitzer, K.S. (Univ. of California, Berkeley, CA). pp 403-420 of Relativistic effects in atoms, molecules, and solids. Malli, G.L. New York, NY; Plenum Press (1983). (CONF-8108115—).

From NATO advanced study institute on relativistic effects in atoms; Vancouver, Canada (16 Aug 1981).

This chapter is principally concerned with the difference between results calculated on the basis of the Dirac, relativistic Hamiltonian from those calculated non-relativistically. Focuses on inner-shell electrons and relativistic effects calculated by the Dirac equation. Discusses effective potentials; the Hamiltonian for valence-electron motion; molecular calculations; and CI-SO calculations. Notes the size and shape of the nucleons and many particle relativistic effects. Explains that the problem of inner-shell electrons becomes more severe with atoms of very high atomic number, and their removal from the detailed calculations is essential for most work with current computers.

6404 Fluid Physics

26464 (AD-A—162330/5/XAB) Neutral-beam interactions with materials. Final report, 1 June 1984-31 October 1985. Gilgenbach, R.M.; Duderstadt, J.J.; Ong, R.S. (Michigan Univ., Ann Arbor (USA). Dept. of Nuclear Engineering). 22 Nov 1985. 104p. NTIS, PC A06/MF A01.

The basic approach involves coupling a one-dimensional hydrodynamic code to an ionization dynamics and an energy-deposition model. Radiation emitted by the plasma is an important diagnostic tool; the ionization dynamics is accomplished by developing an ionization dynamics model which considers a large number of excited states and atomic processes. The atomic processes considered in the model are: 1) collisional ionization; 2) three-body recombination; 3) collisional excitation; 4) collisional de-excitation; 5) spontaneous emission; 6) radiative recombination; and 7) dielectric recombination. A model to calculate the stopping power for energetic, structured (those carrying electrons into the target) low-Z ions was developed. Low-Z ions are both energetic and structured at typical specific energies of a few hundred keV/amu (e.g. 1 MeV helium). The atomic structure is taken into account by describing the electron cloud of the projectile with elastic form factors in the first Born approximation. However, at these energies, the first Born approximation begins to break down. Hence, two corrections are included: the Bloch correction to account for the scattering of wave packets (instead of plane waves) for close collisions, and the Barkas effect which corrects for deviations from pure Rutherford scattering due to the displacement of an oscillating electron. Structure is introduced more approximately in these two terms. An attempt was made to allow sufficient generality to describe ionized targets as well as neutral solids.

26465 (UCRL—94283) Nature of turbulence in a triangular lattice gas automation. Duong-van, Minh. (Lawrence Livermore National Lab., CA (USA)). Mar 1986. Contract W-7405-ENG-48. 11p. (CONF-860164—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86008770.

From Conference on spatio-temporal coherence and chaos in physical systems; Los Alamos, NM, USA (21 Jan 1986).

Power spectra calculated from the coarse-graining of a simple lattice gas automaton, and those of time averaging other stochastic time series that we have investigated, have exponents in the range -1.6 to -2, consistent with observation of fully developed turbulence. This power spectrum is a natural consequence of coarse-graining; the exponent -2 represents the continuum limit. 5 refs., 8 figs.

26466 (UCRL—94304) Transition of fractal dimension in a latticed dynamical system. Duong-van, M. (Lawrence Livermore National Lab., CA (USA)). Mar 1986. Contract W-7405-ENG-48. 11p. (CONF-860164—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86008382.

From Conference on spatio-temporal coherence and chaos in physical systems; Los Alamos, NM, USA (21 Jan 1986).

We study a recursion relation that manifests two distinct routes to turbulence, both of which reproduce commonly observed phenomena: the Feigenbaum route, with period-doubling frequencies; and a much more general route with noncommensurate frequencies and frequency entrainment, and locking. Intermittency and large-scale aperiodic spatial patterns are reproduced in this new route. In the oscillatory instability regime the fracal dimension saturates at D/sub F/ $\approx$ 2.6 with imbedding dimensions while in the turbulent regime D/sub F/ saturates at 6.0. 19 refs., 3 figs.

26467 Nonadiabatic electron heating at high—Mach-number perpendicular shocks. Tokar, R.L.; Aldrich, C.H.; Forslund, D.W.; Quest, K.B. (Inertial Fusion and Plasma Theory, Group X-1, Applied Theoretical Physics Division, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physical Review Letters;* **56**: No. 10, 1059-1062(10 Mar 1986).

Fully kinetic simulations of high—Mach-number perpendicular shocks demonstrate that electron acceleration in the cross-shock electric field can produce downstream electron temperatures significantly higher than that expected for adiabatic compression.

26468 Front tracking for gas dynamics. Chern, I.; Glimm, J.; McBryan, O.; Plohr, B.; Yaniv, S. (Institute of Mathematics, Academia Sinica, Nankang, Taipei, Taiwan, Republic of China). *Journal of Computational Physics;* **62**: No. 1, 83-110(Jan 1986). Contract AC02-76ER03077.

Front tracking is an adaptive computational method in which a lower dimensional moving grid is fitted to and follows the dynamical evolution of distinguished waves in a fluid flow. The method takes advantage of known analytic solutions, derived from the Rankine-Hugoniot relations, for idealized discontinuities. In this paper the method is applied to the Euler equations describing compressible gas dynamics. The main thrust here is validation of the front tracking method: we present results on a series of test problems for which comparison answers can be obtained by independent methods.

6450 High Energy Physics

REFER ALSO TO CITATION(S) 26029

6451 Particle Interactions And Properties - Experimental

26469 (DESY—85-100) Jet production at high transverse momenta by interactions of two quasi-real photons. Berger, C.; Genzel, H.; Lackas, W.; Pielorz, J.; Raupach, F.; Wagner, W.; Klovning, A.; Lillestoel, E.; Ferrarotto, F.; Stella, B. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.); Bergen Univ. (Norway); Rome Univ. (Italy); Glasgow Univ. (UK); Hamburg Univ. (Germany, F.R.). 2. Inst. fuer Experimentalphysik; Maryland Univ., College Park (USA)). Sep 1985. 14p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86751095.

An experimental study of two jet production by interactions of two quasireal photons is presented. The data for production of jets with high transverse momentum squared, psub(T)^2 > 10 GeV^2, are found to be consistent with the fractional charged quark-parton model. If gauge integer charged quark models are considered, then the gluon mass is less than 5 MeV at the 95% confidence level. (orig.).

26470 (DOE/ER/01428—519) High energy particle physics at Purdue. Annual technical progress report, March 1980-March 1981. Gaidos, J.A.; Koltick, D.S.; Loeffler, F.J.; McIlwain, R.L.; Miller, D.H.; Palfrey, T.R.; Shibata, E.I.; Willmann, R.B.; Fowler, E.C.; Barnes, V.E. (Purdue Univ., Lafayette, IN (USA). Dept. of Physics). 18 Mar 1981. Contract AC02-76ER01428. 135p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE86008869.

Progress is reported in these areas: study of electron-positron annihilation using the High Resolution Spectrometer; proton decay experiment; a study of rare processes in meson spectroscopy using the SLAC Hybrid Bubble Chamber System; theory of fundamental problems in gravitational, electromagnetic, weak and strong interactions; experimental neutrino and antineutrino physics; chi production; development of a colliding beam detector; internal target experiment; and theory of elementary particles with an underlying basis of relativistic quantum field theory. (LEW)

26471 (DOE/ER/01428—520) High energy particle physics at Purdue. Annual progress report, March 1981-1982. Gaidos, J.A.; Koltick, D.S.; Loeffler, F.J.; McIlwain, R.L.; Miller, D.H.; Palfrey, T.R.; Shibata, E.I.; Willmann, R.B. (Purdue Univ., Lafayette, IN (USA). Dept. of Physics). 1 Apr 1982. Contract AC02-76ER01428. 208p. NTIS, PC A10/MF A01; 1; GPO Dep. File Number DE86008868.

Progress is reported in these areas: study of electron positron annihilation using the High Resolution Spectrometer at PEP; experimental study of proton decay; a study of rare processes in meson spectroscopy utilizing the SLAC Hybrid Bubble Chamber System; theory of fundamental problems of gravitational, electromagnetic, weak, and strong interactions; experimental study of chi production by hadrons; p-nucleus interactions; development of the Collider Detector at Fermilab; anitneutrino physics and low energy neutrino

physics; and the study of the observed hadrons as the relativistic bound states of baryons and antibaryons. (LEW)

26472 (DOE/ER/01428—521) High energy particle physics at Purdue. Annual technical progress report, March 1982-March 1983. Gaidos, J.A.; Koltick, D.S.; Loeffler, F.J.; McIlwain, R.L.; Miller, D.H.; Palfrey, T.R.; Shibata, E.I.; Willmann, R.B.; Barnes, V.E.; Carmony, D.D. (Purdue Univ., Lafayette, IN (USA). Dept. of Physics). 1 Apr 1983. Contract AC02-76ER01428. 126p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE86008871.

Progress is reported in these areas: a study of electron-positron annihilation using the High Resolution Spectrometer at SLAC; proton decay; extensive muon showers; gamma ray astronomy; the DUMAND project; theoretical work on fundamental problems in electromagnetic, weak, strong, and gravitational interactions; chi production by hadrons; p-nucleus interactions; development of the Collider Detector at Fermilab; and study of the observed hadrons as the relativistic bound states of baryons and antibaryons. (LEW)

26473 (DOE/ER/01428—522) High energy particle physics at Purdue. Annual technical progress report, March 1983-March 1984. Gaidos, J.A.; Koltick, D.S.; Loeffler, F.J.; McIlwain, R.L.; Miller, D.H.; Palfrey, T.R.; Shibata, E.I.; Willmann, R.B.; Barnes, V.E.; Carmony, D.D. (Purdue Univ., Lafayette, IN (USA). Dept. of Physics). 1 Apr 1984. Contract AC02-76ER01428. 136p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE86008870.

Progress is reported in these areas: a study of electron-positron annihilation using the High Resolution Spectrometer; experimental study of proton decay; gamma ray astrophysics; the DUMAND project; fundamental problems in the theory of gravitational, electromagnetic, weak, and strong interactions; chi production by hadrons; study of collective phenomena; search for the onset of collective phenonmena; work on the Collider Detector at Fermilab; search for a deconfined quark-gluon phase of strongly interacting matter at the FNAL proton-antiproton collider; and development of an electrodeless drift chamber. (LEW)

26474 (LA-UR—86-820) Experiment to measure the gravitational force on the antiproton. Brown, R.E. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 16p. (CONF-8510263—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE86008725.

From Workshop on the design of a low energy antimatter facility; Madison, WI, USA (3 Oct 1985).

A collaboration has been formed to measure the acceleration of antiprotons in the earth's gravitational field. The technique is to produce, decelerate, and trap quantities of antiprotons, to cool them to untralow energy, and to measure their acceleration in a time-of-flight experiment. Present plans and the results of initial efforts toward this end are presented.

26475 (LBL—18635, pp 105-106) Stopping power and collective flow of nuclear matter in the reaction Ar + Pb at 0.8 GeV/nucleon. Renfordt, R.E.; Bangert, D.; Brockmann, R.; Harris, J.W.; Odyniec, G.; Pugh, H.G.; Rauch, W.; Sandoval, A.; Stock, R.; Stroebele, H. May 1985. NTIS, PC A12/MF A01. File Number DE85013312.

In Nuclear Science Division annual report, October 1, 1983-September 30, 1984.

Several attempts have been made to identify hydrodynamic sideward flow from inclusive or high multiplicity selected inclusive data marginal success. Recently, a sideward deflection of matter was reported for charged-particle exclusive data in the symmetric Nb + Nb system at 400 MeV/nucleon. To search for collective effects and their influence on the flow of nuclear matter in central collisions of non-symmetric target-projectile systems, a charged-particle exclusive experiment was carried out for the reaction ^{40}Ar + Pb at 0.772 GeV/nucleon at the Bevalac Streamer Chamber facility.

26476 (LBL—21084) Search for right-handed currents in muon decay. Jodidio, A.E. (Lawrence Berkeley Lab., CA (USA)). Jan 1986. Contract AC02-76ER02289;AC03-76SF00098. 115p. NTIS, PC A06/MF A01; GPO Dep. File Number DE86008399.

Thesis.

Limits are reported on charged right-handed currents, based on precise measurement of the endpoint e^+ spectrum in μ^+ decay. Highly polarized μ^+ from the TRIUMF "surface" muon beam were stopped in high purity metal foils and liquid He targets selected to minimize depolarization effects. Decay e^+ emitted within 160 mrad of the beam direction were momentum-analyzed to 0.15%. Muons were stopped within either a spin-processing transverse field (70-G or 110-G) or a spin-holding longitudinal field (0.3-T or 1.1-T). Data collected with the spin-precessing field were used for the momentum calibration of the spectrometer. The spin-held data were used to measure the relative e^+ rate at the endpoint. An extrapolation was made to extract the endpoint rate opposite to the μ^+ spin. In terms of the standard muon decay parameters this rate is given by (1-xi P/sub μ/δ/rho) where P/sub μ/ is muon polarization. The result for xi P/sub μ/δ was consistent with the V-A prediction of 1. It is quoted as a 90% confidence lower limit xi P/sub μ/δ/rho $>$ 0.9975 since we are unable to correct for all possible sources of muon depolarization. For the model with manifest left-right symmetry and massless neutrinos the result implies 90% confidence limits $m(W_2) > 432$ GeV/c^2 and $-0.050 < xi < 0.035$, where W_2 is the predominantly right-handed boson and xi is the left-right mixing angle. With the assumption of no left-right mixing an equivalent 90% confidence upper limit of 0.025 is obtained on the absolute value of the ratio of a possible V+A amplitude to the dominant V-A amplitude in muon and pion decays. Limits are also deduced on the nu/sub μL/ mass and helicity in π^+ decay, non-(V-A) couplings in helicity projection form, the mass scale of composite leptons, and the branching ratio for $\rightarrow$ e+f where f (familon) is the neutral massless Nambu-Goldstone boson associated with flavor symmetry breaking. 39 refs., 12 figs.

26477 (SLAC—290) Measurement of the charged and neutral D meson lifetimes. Butler, J.M. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Feb 1986. Contract AC03-76SF00515. 64p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE86008469.

In an exposure of the SLAC Hybrid Facility (SHF) to a backward scattered laser beam, 136 charm events produced in γp interactions at 20 GeV have been observed. The SHF 1 m bubble chamber was equipped with a High Resolution Optics camera in order to detect directly the production and decay of charm particles. After imposing rigorous cuts, 48 charged, 50 neutral, and 2 topologically ambiguous decays remain. Using a novel method for estimating the momentum of unconstrained decays, the D meson lifetimes from this sample are measured to be tau/sub D sup +-/ = (8.6 +- 1.3/sub -0.3//sup +0.8/) x 10^{-13} sec and tau/sub D^0/ = (6.1 +- 0.9 +- 0.3) x 10^{-13} sec with a ratio of R = tau/sub D sup +-//tau/sub D^0/ = (1.4 +- 0.3/sub -0.1//sup +0.2/). This value of R indicates the Spectator Model charm particle decay mechanism is the dominate piece in the D/sub +-/ and D^0 decay rates. Limits are placed on additional contributions to the D decay rates from other processes including W-Exchange, Final State Interactions, and Pauli Principle Interference. 34 refs., 41 figs.

26478 (USIP—85-15) F meson background and F candidates in 360 GeV/c πp and pp interactions. Fischer, C.; Holmgren, S.O.; Johansson, K.E.; Moa, T.; Nilsson, S. (Stockholm Univ. (Sweden). Inst. of Physics). Jun 1985. 18p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701548.

The background to a search for F meson decays in high energy hadron interactions arises mainly from misinterpreted D meson decays. In the high resolution bubble chamber experiment (NA16) at CERN, three events were observed which give constrained kinematic fits to F decays; however, other solutions are possible. In this paper we discuss the analysis difficulties in the presence of kinematic ambiguities and the absence of charged particle identification. We note that two of the three decays discussed are to modes where charged particle identification would not resolve D/F ambiguities.

26479 (USIP—85-16) Treatment of strange particle decays observed in the UA5 streamer chambers. Jon-And, K.; Walck, C. (Stockholm Univ. (Sweden). Inst. of Physics). Jul 1985. 45p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86701547.

Decay vertex fits and momentum determination of strange particles, as observed by the UA5 experiment, are described. The precision of the evaluated quantities is discussed. Weighted fit methods, with constraints given by the kinematics of the decay, are shown to be advantageous compared to unweighted methods.

26480 Formation of delta(980) and A_3(1320) in photon-photon collisions. Antreasyan, D.; Aschman, D.; Besset, D.; Bienlein, J.K.; Bloom, E.D.; Brock, I.; Cabenda, R.; Cartacci, A.; Cavalli-Sforza, M.; Clare, R. (California Institute of Technology, Pasadena, California 91125). *Physical Review [Section] D: Particles and Fields;* **33**: No. 7, 1847-1851(1 Apr 1986). Contract AC03-81ER40050;AC02-76ER03066;AC02-76ER03064;AC02-76ER03072.

The reaction $\gamma\gamma \rightarrow \pi^0$eta has been investigated with the Crystal Ball detector at the DESY storage ring DORIS II. Formation of $\delta(980)$ and $A_3(1320)$ has been observed with $\gamma\gamma$ partial widths Γ/sub $\gamma\gamma/(A_3) = 1.14 +- 0.20 +- 0.2$ 6 keV and Γ/sub $\gamma\gamma/(\delta)B(\delta \rightarrow \pi$eta$) = 0.19 +- 0.07$ /sub -0.07//sup +0.10/ keV.

26481 Charmed quark fragmentation in e^+e^- annihilations at 29 GeV. Stroynowski, R. (California Inst. of Tech., Pasadena, CA). pp 287-292 of Electroweak effects at high energies. Newman, H.B. New York, NY; Plenum Press (1985). (CONF-830231—).

From Europhysics study conference on electroweak effects at high energies; Erice, Italy (1 Feb 1983).

This paper reports on the fragmentation of charmed quark into D^* as measured with the DELCO detector at PEP. DELCO is an upgraded SPEAR detector with the emphasis on good particle identification. Charmed quark fragmentation in electron-positron interactions results predominantly in the D and D^* particles. It is determined that at 29 GeV, the cross section is dominated by charm quark production, and that the secondary charm contribution due to bottom fragmentation is negligible in the kinematic range of the experiment.

26482 Weak mixing and the structure of charged currents. Chau, L.L. (Brookhaven National Lab., Upton, NY). pp 329-358 of Electroweak effects at high energies. Newman, H.B. New York, NY; Plenum Press (1985). (CONF-830231—).

From Europhysics study conference on electroweak effects at high energies; Erice, Italy (1 Feb 1983).

The knowledge of the quark mixing matrix and experimental implications from the Kobayashi-Maskawa model are presented. Nonleptonic decays, neutral particle-antiparticle mixing and CP violations in heavy quark systems are discussed.

6452 Particle Interactions And Properties - Theoretical

REFER ALSO TO CITATION(S) 26470, 26471, 26472, 26473, 26528, 26536

26483 (BNL—37779) Large scale calculations for hadron spectroscopy. Rebbi, C. (Brookhaven National Lab., Upton, NY (USA)). 1985. Contract AC02-76CH00016. 18p. (CONF-8509213—6). NTIS, PC A02/MF A01; GPO Dep. File Number DE86008006.

From Frontiers of quantum Monte Carlo conference; Los Alamos, NM, USA (3 Sep 1985).

The talk reviews some recent Monte Carlo calculations for Quantum Chromodynamics, performed on Euclidean lattices of rather large extent. Purpose of the calculations is to provide accurate determinations of quantities, such as interquark potentials or mass eigenvalues, which are relevant for hadronic spectroscopy. Results obtained in quenched QCD on 16^3 x 32 lattices are illustrated, and a discussion of computational resources and techniques required for the calculations is presented. 18 refs.,3 figs., 2 tabs.

26484 (CBPF-NF—015/85) Helicity amplitude analysis of the reaction πi p$\rightarrow\Delta^{++}(\pi^+\pi\pi^0)$ in the eta^0 and ω^0 region at 16 GeV/C. Endler, A.M.F.; Girtler, P.; Pinto, H.V. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro; Innsbruck Univ. (Austria). Inst. fuer Theoretische Physik; Universidade Federal Fluminense, Niteroi (Brazil)). 1985. 27p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86701535.

An amplitude analysis has been performed for the reactions $\pi^+p \rightarrow$ (eta^0, ω^0)Δ^{++} at 16 GeV/c, constraining the relative spin between the target proton and the Δ^{++} to be 1. The amplitudes are determined in intervals of t' by a maximum likelihood fit. The quality of the fits is checked by comparing the experimental decay angular distributions of the eta^0, ω^0 and Δ^{++} in the Gottfried-Jackson system. The structure observed in the magnitudes and phases of the obtained amplitudes is consistent with that expected on the basis of currently accepted phenomenological ideas.

26485 (DESY—85-099) Renormalization scheme dependence of electroweak radiative corrections. Hollik, W.; Timme, H.J. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Sep 1985. 20p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86751098.

We compare two renormalization schemes of the electroweak standard model: the on-shell scheme with e, Msub(W), Msub(Z), Msub(H), and the fermion masses [msub(f)] as free parameters, and an intermediate scheme where the W boson self energy is renormalized at $q^2 = 0$ instead of $q^2 =$ Msub(W)^2. Using the same physical input data for both schemes, various Green functions, the Msub(W)-Msub(Z) mass relation, and the differential e^+e->$\mu^+\mu$ cross section are calculated in one-loop order. We find striking differences between the forward-backward asymmetries predicted in either of the schemes near the Z resonance. (orig.).

26486 (DESY—85-102) Preon model with minimal color-flavor number and low composite energy scale. Li Xiaoyuan. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Oct 1985. 16p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86751094.

A preon model with minimal color-flavor number and low composite energy scale is proposed. Three generations of massless quarks and leptons (but no exotic fermions) can be reproduced by assuming the global chiral symmetry SU(10) of the preon Lagrangian to be spontaneously and maximally broken down to unbroken chiral subgroup SU(3)sub(L) x SU(3)sub(R) x SU(2)sub(L) x U(1)sub(Y) which minimally contains the gauge group SU(3)sub(C) x SU(2)sub(L) x U(1)sub(Y) of the standard model as a subgroup. The 't Hooft anomaly matching condition naturally leads to the generation structure of quarks and leptons. A constraint from coupling of this theory to gravity is also considered. (orig.).

26487 (DESY—85-104) Pion mass: Looking for its origins. Peccei, R.D. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Oct 1985. 25p. (CONF-8508120—5). NTIS (US Sales Only), PC A02/MF A01. File Number DE86751097.

From Kyoto international symposium: the jubilee of the meson theory; Kyoto, Japan (15 Aug 1985).

After explaining why pions are special excitations in QCD, I discuss how the pion mass reflects directly the dynamical scale of the strong interactions (Asub(QCD)) and the scale of breaking of the weak interactions (Asub(F)). To actually calculate the pion mass, however, requires understanding the origin of the quark masses and so I compare and contrast approaches to this latter problem, based on composite models and on superstrings. (orig.).

26488 (DESY—85-107) Dileptons, electroweak charge asymmetry and B-anti B mixings. Ali, A. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Oct 1985. 17p. (CONF-8506194—9). NTIS (US Sales Only), PC A02/MF A01. File Number DE86751096.

From International symposium on multiparticle dynamics; Kiryat Anavim, Israel (9 Jun 1985).

We discuss the implications of B- anti B mixings in e^+e annihilation and anti pp collisions. A comparative analysis of the recent

data for the processes $e^+e \rightarrow \mu sup(+-)\mu sup(+-)X$ and anti $pp \rightarrow \mu sup(+-)\mu sup(+-)X$ is presented in the context of standard model. An analysis of B-anti B mixing effects on the electroweak charge asymmetry in $e^+e \rightarrow$ b anti b -> lsup(+-)X is also presented. (orig.).

26489 (DOE/ER/05126—254) Chiral Quark-Meson model of N and DELTA with vector mesons. Broniowski, W.; Banerjee, M.K. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy). Oct 1985. Contract AS05-76ER05126. 59p. (ORO—5126-254). NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE86007349.

Vector mesons rho, A_1 and ω are introduced in the Chiral Quark-Meson Theory (CQMT) of N and Δ. We propose a new viewpoint for developing CQMT from QCD at the mean-field level. The SU(2) x SU(2) chiral Lagrangian incorporates universal coupling. Accordingly, rho is coupled to the conserved isospin current, A to the partially conserved axial-vector current (PCAC), and ω to the conserved baryon current. As a result the only parameter of the model not directly related to experiment is the quark-pion coupling constant. A fully self-consistent mean-field solution to the model is found for fields in the hedgehog ansatz. The vector mesons play a very important role in the system. They contribute significantly to the values of observables and produce a high-quality fit to many data. The classical stability of the system with respect to hedgehog excitations is analyzed through the use of the Quark-Meson RPA equations (QMRPA).

26490 (DOE/ER/40235—1) Theoretical studies in elementary particle physics. Technical progress report, September 1, 1985-May 31, 1986. Collins, J.C. (Illinois Inst. of Tech., Chicago (USA)). 1986. Contract FG02-85ER40235. 11p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86008865.

Since July 1985, most of the work has continued to be on problems in perturbative QCD that are relevant to physics at hadron collider - both for the Sp anti p S and the Tevatron, and for the proposed SSC. Some interesting problems have turned out to involve the relation between perturbative QCD and Regge theory - in diffractive hard scattering and in understanding the small-x behavior of parton distributions. 13 refs.

26491 (INIS-mf—9863) Polarized electron-positron scattering and annihilation in the Salam-Weinberg model. Wadan, K. (Muenchen Univ. (Germany, F.R.). Fakultaet fuer Physik). 28 Mar 1984. 189p. (In German). NTIS (US Sales Only), PC A09/MF A01. File Number DE86751093.

In this thesis the lepton-antilepton scattering respectively production in the Salam-Weinberg model is treated. Thereby in the initial state arbitrary lepton-antilepton pairs and in the final state arbitrary fermion-antifermion pairs are permitted. The calculations have been performed analytically and beyond this with the symbol processing (non-numerical) code SCHOONSCHIP. Thereby topics were regarded in comparison to the calculations hitherto present: i) The particles are in the initial and final state arbitrarily polarized. ii) No high-energy approximation is made. iii) All contributions of the fields characteristic for the Salam-Weinberg model are regarded. iv) Beside the resonance widths also the $Ksub(\mu)Ksub(\nu)$ terms in the propagators for the vector fields are fully included in the calculations. v) The scattering plane and the laboratory plane can be mutually oriented arbitrarily. From the manifold of the scattering processes which can be described by these formulas only Bhabha scattering and lepton pair production in e^+e interactions are numerically evaluated and discussed. As typical example for the production of the up quarks the canti c production and for the production of the down quarks the banti b production is treated. The evaluation was performed for three different energies, different degrees of polarization and configurations, and different orientations of the scattering plane relatively to the laboratory plane. (orig./HSI).

26492 (INS—506) Mass spectra of composite fermions in a three fermionic preon model with chiral SU(3)sub(C)xU(1)sub(B-L) symmetry. Yasue, Masaki. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Aug 1984. 19p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701536.

Mass spectra of composite fermions are studied in a preon model with approximate chiral SU(3) sub(C)xU(1)sub(B-L)xSU(2)sub(f) symmetry. Composite leptons and quarks acquire masses, respectively, given by msub(O)Msub(f) / Asub(H) and msub(C)Msub(f) / Asub(H), where msub(O), msub(C) and Msub(f) are the mass scales for the chiral U(1)sub(B-L), SU(3)sub(C) and SU(2)sub(f) symmetry breakings, respectively, and where Asub(H) is about inverse sizes of leptons and quarks. The universal ratio msub(C)/msub(O)--O(10) may indicate msub(u)/msub(e) (asymptotically equals5/.5)--msub(c)/msub(mu) (asymptotically equals1200-1500/105)--msub(t)/msub(tau) (asymptotically equals[/1800)--O(10), which predicts msub(t)asymptotically equals30-40 GeV for msub(t)/msub(tau)asymptotically equals15-20. An explicit example is given by three fermionic preon model of the Pati-Salam-Strathdee and Terazawa-Chikashige-Akama type. The chiral SU(2)sub(f) symmetry is dynamically broken at Asub(f) by sextet "quarks" due to QCD and Msub(f) turns out to be of order $Asub(f)^2/Asub(H)$ where Asub(f) is 1/2-1 TeV. This model predicts light exotic fermion with masses of order 100 GeV.

26493 (INS—507) Quarks and gluons at finite temperature and density. Nakamura, Atsushi. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Sep 1984. 18p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701537.

We have run computer simulation in SU(2) lattice gauge theory on a $8^3 \times 2$ lattice including dynamical quark loops. No rapid variation is observed in the value of Polyakov line, while the energy densities of quark and gluon show strong indication of a second order phase transition around T asymptotically equals 250 MeV. In order to reduce finite size effects, the results are compared with those of free gas on a lattice of the same size. The quark and gluon energy densities overshoot the free gas values at high temperature. The effects of chemical potential is also studied. The behavior of the energy densities and the number densities are far from a free gas case.

26494 (INS—508) Charge commutation relation approach to composite vector bosons in SU(2)sub(L)xU(1)sub(Y). The case with W* and Z*. Yasue, Masaki; Oneda, Sadao. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Sep 1984. 14p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701531.

Under the assumption that the local SU(2)sub(L)xU(1)sub(Y) symmetry is a good symmetry for new resonances, we predict that msub(W)msub(W*)=costhetamsub(Z)msub(Z*) where theta represents the mixing angle between neutral gauge bosons and msub(W), msub(Z), msub(W*) and msub(Z*) are the masses of W, Z, W* and Z*, respectively. W* and Z* are the lowest lying spin one resonances, whose pure states belong to a triplet of SU(2)sub(L). Possible SU(2)sub(L)-singlet state is assumed to be much heavier than W* and Z*. Low energy phenomenology of weak interactions indicates msub(W)--costhetamsub(Z), suggesting msub(W*)--msub(Z*).

26495 (INS—509) Subcomponent Models. Terazawa, Hidezumi. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Sep 1984. 9p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701538.

According to the instruction given by Professor Lanius and Professor Uhlman, the Conference Chairmen, and by Professor Ranft and Professor Nowak, the Chairmen of the Program Committee, I have organized the Session B04 "Subcomponent Models" in the following way: First, I have tried to review recent theoretical works on composite models of quarks and leptons, including twenty-six contributed papers allocated to this session, with the title of "Composite Models". Next, I have asked Professor Yamada from University of Tokyo to review recent experimental works related to this subject, including three contributed papers allocated to this session, with the title of "Experimental Search for Compositeness". After that, I have invited Professor Mohapatra from University of Maryland and Professor Nielsen from Niels Bohr Institute to give talks on their own recent works contributed to this session, with the titles of "Fermion Generations and Compositeness" and "Field Theories without Fundamental (Gauge) Symmetry", respectively.

26496 (LBL—20492) Properties of supersymmetric particles and processes. Barnett, R.M. (Lawrence Berkeley Lab., CA (USA)). Jan 1986. Contract AC03-76SF00098. 113p. (CONF-850768—9). NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE86008398.

From SLAC summer institute on particle physics; Stanford, CA, USA (23 Jul 1985).

The motivations for experimental searches for supersymmetric particles are discussed. The role of R-parity in these searches is described. The production and decay characteristics of each class of supersymmetric particles are investigated in the context of both e+e- and hadron machines. There is a detailed presentation of a sample calculation of a supersymmetric process. Emphasis is given to the signatures for detection of supersymmetric particles and processes. The current limits for supersymmetric particles are given. 125 refs., 50 figs.

26497 (RAL—85-069) Jets. The materialisation of quarks and gluons. Marshall, R. (Rutherford Appleton Lab., Chilton (UK)). Sep 1985. 19p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701539.

The paper, which is aimed at scientists outside the immediate field of particle physics, describes some of the properties of jets and how the jet observables can be related to quark parameters. The similarity of quark and leptons is underlined.

26498 (RAL—85-072) Top and bottom expectations at the CERN pp-bar collider. Phillips, R.J.N. (Rutherford Appleton Lab., Chilton (UK)). May 1985. 15p. (CONF-8505229—1). NTIS (US Sales Only), PC A02/MF A01. File Number DE86701532.

From New particles conference; Madison, WI, USA (8 May 1985).

A brief summary is made - with illustrative calculations - of the expectations for b and t quark production and detection at the CERN pp-bar collider.

26499 (RIFP—500) Fractional charges at finite temperature. Midorikawa, Shoichi. (Kyoto Univ. (Japan). Research Inst. for Fundamental Physics). Mar 1983. 7p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86900875.

Quantum numbers on solitons are studied at finite temperature. It is found that the thermal expectation value of fermion number on kinks or magnetic monopoles vanishes at sufficiently high temperatures. This result can be interpreted as the decoupling of fermions from solitons at very high temperatures. 5 refs., 1 fig.

26500 (RRK—84-16) Phenomenological analysis of Zsup(o) → l-barlγ decay on excited lepton hypothesis. Nakazato, Hiromichi; Namiki, Mikio; Yamanaka, Yoshiya; Yokoyama, Kan-ichi. (Hiroshima Univ., Takehara (Japan). Research Inst. for Theoretical Physics). Jul 1984. 15p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701534.

We phenomenologically investigate the angular distribution and decay rate of the anomalous events Zsup(o)→l-barlγ in p-barp collision on excited lepton hypothesis, assuming a possible non-conserved current as well as magnetic one for radiation of photons. It is shown that hypothetical existence of excited leptons and its feature are easily tested in furture experiment. The UA1 and UA2 collaborations have confirmed the existence of both the Zsup(o) and W^+ bosons predicted by the standard Weinberg-Salam model. At the same time, we have been surprised at three "anomalous" Zsup(o) events Zsup(o)→l-barlγ, because of the relatively high event rate among twelve Zsup(o) events and further of being accompanied by a hard photon (>= 20(GeV)) emitted with wide angles from both of leptons. Note that the events are characterized by invariant masses: m_1(or m_3) = 70 – 80(GeV), m_2(or m_1) = 5 – 10(GeV) and m_{12} = 40 – 50(GeV) (see Fig. 1). This observation has prompted the search for the similar radiative decay process $W^+ \to l^+ \nu\gamma$ with an energetic photon but no new event has been found apart from QED radiative effects.

26501 (RRK—84-18) Weak bosons as composite gauge fields of hidden symmetries. Kugo, T.; Uehara, S.; Yanagida, T. (Hiroshima Univ., Takehara (Japan). Research Inst. for Theoretical Physics). Jul 1984. 11p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701533.

We find a hidden local symmetry in the supersymmetric U(4nsub(f)+2)/U(4nsub(f))xSU(2) non-linear sigma model which was proposed recently as a phenomenological model coming from the SU(2) preon theory. The hidden symmetry is identifiable with the standard electro-weak SU(2)sub(L) gauge symmetry and thus we suggest that the weak intermediate bosons discovered at CERN may be dynamical gauge fields of the hidden symmetry.

26502 (SLAC—291) Systematics of meson-Skyrmion scattering. Mattis, M.P. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Feb 1986. Contract AC03-76SF00515. 77p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE86008145.

The S-matrix characterizing the scattering of pions from nucleons is calculated in the context of skyrmion models of the nucleon. These are models in which the nucleon is considered a soliton in the field of pions. The spectrum of nucleon and delta resonances in the Skyrme model is calculated and found to be in overall good agreement with Nature. Model-independent sum rules between amplitudes in the same partial wave are derived and examined. An extension of the formalism to the case of three light flavors is presented. 31 refs., 26 figs., 6 tabs.

26503 Determination of baryon magnetic moments from QCD sum rules. Chiu, C.B.; Pasupathy, J.; Wilson, S.J. (Center for Particle Theory, The University of Texas at Austin, Austin, Texas 78712). *Physical Review* [*Section*] *D: Particles and Fields;* **33**: No. 7, 1961-1973(1 Apr 1986). Contract AS05-76ER03992.

The magnetic moment μ/sub B/ of a baryon B with quark content (aab) is written as μ/sub B/ = 4e/sub a/(1+δ/sub B/)eh/2cM/sub B/, where e/sub a/ is the charge of the quark of flavor type a. The experimental values of δ/sub B/ have a simple pattern and have a natural explanation within QCD. Using the ratio method, the QCD sum rules are analyzed and the values of δ/sub B/ are computed. We find good agreement with data (roughly-equal10%) for the nucleons and the Σ multiplet while for the cascade the agreement is not as good. In our analysis we have incorporated additional terms in the operator-product expansion as compared to previous authors. We also clarify some points of disagreement between the previous authors. External-field-induced correlations describing the magnetic properties of the vacuum are estimated from the baryon magnetic-moment sum rules themselves as well as by independent spectral representations and the results are contrasted.

26504 Extra fermions in E_6 superstring theories. Barger, V.; Deshpande, N.G.; Phillips, R.J.N.; Whisnant, K. (Physics Department, University of Wisconsin, Madison, Wisconsin 53706). *Physical Review* [*Section*] *D: Particles and Fields;* **33**: No. 7, 1912-1924(1 Apr 1986). Contract AC02-76ER00881;FG06-85ER40224.

In E_6 superstring theories, there are new fermion fields which lie in the 27-dimensional representation along with the known fermions. We examine possible production modes of these exotic fermions and their likely decays. Whereas e^+e^- collider data exclude new charged fermions with masses below 23 GeV, it appears that present pp-bar collider data for dimuons and for isolated single electrons exclude exotic quarks with masses below 30 GeV and considerable regions of lepton mass assignments in the range 20-45 GeV (assuming m/sub E/>mE,m/sub N//sub E/). We place constraints on the mixings of the exotic fermions from experimental limits on flavor-changing neutral currents and the observed weak universality of charged-current interactions. The decays of the exotic h quark (singlet, charge -(1/3)) satisfy the bound Γ(h→de$^+$e$^-$)/Γ(h→ueν)> or ≈12%. Production and decays of very heavy exotics are also considered.

26505 Skyrmions in the presence of vector mesons. Meissner, U.; Zahed, I. (Institute of Theoretical Physics, University of Regensburg, D-8400 Regensburg, Germany). *Physical Review Letters;* 56: No. 10, 1035-1038(10 Mar 1986). Contract AC02-76ER13001.

The nonlinear σ model with the Wess-Zumino term is extended to the low-lying vector meson resonances ω, rho and A_1. These resonances are treated as chiral gauge multiplets in a minimally broken SU(2)/sub L/xSU(2)/sub R/xU(1)/sub V/ gauge model. The bulk properties of hedgehog skyrmions are investigated. The results indicate a clear improvement over the conventional Skyrme model.

26506 Evidence for explicit glueballs from the reaction $\pi p \rightarrow$/phi//phi/n. Lindenbaum, S.J. (Brookhaven National Laboratory, Upton, NY). pp 615-652 of Gauge interactions theory and experiment. Zichichi, A. New York, NY; Plenum Press (1984). (CONF-8208100—).

From 20. course on gauge interactions: theory and experiment international school of subnuclear physics; Erice, Trapani, Italy (3 Aug 1982).

In a pure Yang-Mills theory where SU(3) /sub c/ has local gauge symmetry, all hadrons would be glueballs (i.e., multi-gluon resonances). This is due to the self-coupling of the gluons which becomes stronger with decreasing energy and color confinement. But what do we find experimentally? The hadronic sector is dominated by qq and qqq and there is yet no prior "experimental" demonstration of the explicit existence of glueballs, although there were a number of glueball candidates and extensive discussion of them. Thus the quarks which are a source of particles for gluons in QCD appear to have completely taken over the hadronic sector. Therefore finding glueballs is crucial to QCD, Grand Unification Schemes and Partial Unification Schemes which utilize SU(3) /sub c/. In fact it has been the author's opinion for some time that if we don't establish glueballs, QCD is in serious trouble. On the other hand, the explicit establishment of glueball's would indeed be a great triumph for QCD.

6453 Particle Invariance Principles And Symmetries

REFER ALSO TO CITATION(S) 26496, 26538, 26637, 26641

26507 (CBPF-NF—029/85) Elementary particles and physical interaction unification. Lopes, J.L. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1985. 50p. (In French). NTIS (US Sales Only), PC A03/MF A01. File Number DE86701540.

Recent ideas on the elementary particles and the origin of the concepts of the gauge field theory and interaction unification are presented.

26508 (CBPF-NF—039/85) Double groups of point groups. Caride, A.O.; Zanette, S.I. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1985. 10p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701478.

The representations of point groups appropriate to spin -1/2 particles are usually determined by considerations of a group of double the order of the point group under consideration, known as the double group. An alternative definition for double groups is given which makes use of the theory of central extensions and presentations of the point groups.

26509 (CBPF-NF—047/85) Supersymmetric Klein-Gordon equation in d-dimensions. Bollini, C.G.; Giambiagi, J.J. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1985. 13p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701479.

The simple supersymmetric Wess-Zumino model is extended to arbitrary $d=4\nu$ dimensions. The components of the quiral superfield are found to obey a higher order Klein-Gordon-type equation, whose green functions are discussed.

26510 (CBPF-NF—051/85) Bosonic Polyakov's string with fermionic boundaries for the Makeenko-Migdal contour Q.C.D. (SU(infinite)) equation. Botelho, L.C.L. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1985. 13p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701541.

A simple bosonic Polyakov's string with fermionic boundaries is proposed for the Makeenko-Migdal contour Q.C.D. (SU(infinite)) equation.

26511 (CBPF-NF—056/85) Fermionic determinant in two and four dimensions. Mignaco, J.A.; Rego Monteiro, M.A. do. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1985. 26p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86701542.

The fermionic determinant of the two-dimensional Schwinger model and QCD and a four-dimensional model with a pseudo-vectorial coupling are discussed. It is observed that in both cases the Dirac operator can be expressed as a path-ordered product of the gauge field and the fermionic determinant is computed exactly without reference to a particular gauge. The two point Green's function is obtained in all cases as a free particle two point function times a model dependent term.

26512 (DOE/ER/40215—T1) Concerning the transformation behavior of fields under the superconformal symmetries. Pilot, C.H. (Oklahoma State Univ., Stillwater (USA). Dept. of Physics). Dec 1985. Contract FG05-85ER40215. 29p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86009008.

The transformation behavior of fields under external type symmetries (such as the superconformal group) is gone over emphasizing the formal distinction between the group transformations of fields and their Lie transformations (often called Lie derivatives). We show how some of the standard results ordinarily expected for the Poincare group have to be generalized if the full symmetries of the superconformal group are to be respected. As far as classical scalar field theories go only massless phi^4 theories are superconformaliy invariant.

26513 (DOE/ER/40215—T2) Superconformal Lagrangian without the need to introduce constraints. Pilot, C.H. (Oklahoma State Univ., Stillwater (USA). Dept. of Physics). Jan 1986. Contract FG05-85ER40215. 40p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86009006.

A field Lagrangian invariant under all the symmetries of the superconformal group has been constructed without the need to introduce constraints on the curvatures. We have thus generalized the action of Townsend, van Nieuwenhuizen, and Kaku. We maintain that any and all constraints on the curvatures should result as a consequence of spontaneous symmetry breaking and not be a priori enforced. 14 refs.

26514 (INS—504) Canonical formulation of covariant superstring. Kamimura, Kiyoshi; Hori, Takayuki. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Aug 1984. 12p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701482.

The covariant action for superstring is studied in canonical formalism. It has fermionic local gauge symmetry as well as the bosonic one. The generators form a closed algebra. There is also global supersymmetry, which is combined with the Poincare symmetry to form super Poincare group depending on the boundary conditions. We construct all the generators of these transformations and find the algebras. In the light cone gauge, the system is soluble and the positive definite quantization will be possible.

26515 (INS—510) Magnetic monopoles in a model of a composite photon. Iwazaki, Aiichi. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Oct 1984. 12p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701543.

We show that there are monopole solutions in a composite model where the photon is regarded as a composite of elementary constituents. These monopoles have magnetic charges of the Dirac unit but are essencially different from 't Hooft-Polyakov monopoles

since they are bound states of the constituents. The stability of the monopoles is guaranteed by the conservation of the magnetic charges.

26516 (INS—511) Supergrand unified composite model in pregeometry. Terazawa, Hidezumi. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Oct 1984. 10p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701544.

The supergrand unified theory of composite particles and fields in pregeometry is reviewed. It effectively reproduces not only unified gauge theories for the strong and electroweak forces of leptons and quarks but also general relativity for gravity at low energies and predicts the fundamental relations of the type $e^2 = 16\pi GM^2$, where e, G and M are the gauge coupling constant, the Newtonian gravitational constant and the subquark mass, which indicates M asymptotically equals 10^{19}GeV. Some other consequences of this theory are also discussed.

26517 (KFKI—1985-74) Cosmology and the large mass problem of the Kaluza-Klein theory. Lukacs, B.; Pacher, T. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics; Lorand Eoetvoes Univ., Budapest (Hungary). Inst. for Theoretical Physics). Jul 1985. 7p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701546.

The Kaluza-Klein theory is an attempt to unify the gravity and electromagnetism in a five-dimensional geometrical framework with compactified fifth coordinate. It is shown that the belief of natural explanation of the Dirac's large number problem (i.e the large ratio of electromagnetic and gravitational forces) by the Kaluza-Klein theory is false: the ratio in question is derived to be about 1. The connection between this fact and the other critical point of the Kaluza-Klein theory, the appearance of particles of normal electric charge but of very large mass (about Planck mass) is discussed.

26518 (LBL—20747) Quest for supersymmetry. Hinchliffe, I. (Lawrence Berkeley Lab., CA (USA)). Dec 1985. Contract AC03-76SF00098. 90p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE86008397.

The notation of supersymmetric models is presented and the assumptions of supersymmetry are discussed. The various limits which can be applied to supersymmetric models from cosmological considerations are considered. Direct searches for supersymmetry in electron-positron and hadron machines are discussed. The constraints from rare processes are considered, and an overview is given of the prospects for future searches and ways of evading the existing limits. 135 refs., 57 figs., 4 tabs. (LEW)

26519 (PB—86-143906/XAB) Irreducible density matrices. Danos, M. (National Bureau of Standards, Washington, DC (USA). Center for Radiation Research). Nov 1985. 27p. (NBSIR—85/3270). NTIS, PC A03/MF A01.

An expansion of the density matrix is given into irreducible SU(2) tensors, i.e., into quantities of good angular momentum. These irreducible tensors can be handled by all the powerful tools developed in the context of the handling of angular momentum. As examples, the density matrix of a cryogenically alligned nucleus is derived and the construction of the angular distributions of nuclear reactions in terms of density matrices is demonstrated.

26520 (SLAC-PUB—3866) Parity anomalies in gauge theories in 2 + 1 dimensions. Rao, S.; Yahalom, R. (Stanford Linear Accelerator Center, Menlo Park, CA (USA); Fermi National Accelerator Lab., Batavia, IL (USA); California Inst. of Tech., Pasadena (USA)). Jan 1986. Contract AC03-76SF00515. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86008296.

We show that the introduction of massless fermions in an abelian gauge theory in 2+1 dimensions does not lead to any parity anomaly despite a non-commutativity of limits in the structure function of the odd part of the vacuum polarization tensor. However, parity anomaly does exist in non-abelian theories due to a conflict between gauge invariance under large gauge transformations and the parity symmetry. 6 refs.

26521 Baker—Campbell—Hausdorff relations for supergroups. Kostelecky, V.A.; Nieto, M.M.; Truax, R. (Theoretical Division, Los Alamos National Laboratory, University of California, Los Alamos, New Mexico 87545). *Journal of Mathematical Physics (New York);* **27**: No. 5, 1419-1429(May 1986). Contract W-7405-ENG-36.

One-parameter subgroups, the exponential mapping, and canonical coordinates have previously been defined for connected supergroups. In this paper, a technique for obtaining analytical expressions linking different coordinate schemes for supergroups is presented. These are the Baker—Campbell—Hausdorff relations. The method is illustrated in detail with the examples of supergroups based on the supersymmetric quantum-mechanical superalgebra sqm (2) and on the Inoenue—Wigner contraction isop(1/2) of the simple superalgebra osp(1/2).

26522 Numerical results for the line-line correlation length near the SU(2) deconfining phase transition. Kiskis, J. (Department of Physics, University of California at Davis, Davis, California 95616). *Physical Review [Section] D: Particles and Fields;* **33**: No. 8, 2380-2382(15 Apr 1986).

Results from a Monte Carlo simulation of SU(2) pure gauge theory near the finite-temperature, deconfining phase transition are presented. The lattice is $11^3 \times 4$, and the data were collected at values of $4/g^2 = 2.200$, 2.225, 2.250, and 2.275 that approach the transition from the low-temperature, confinement side. The Wilson line-line correlation function was measured and the correlation length extracted. The data are consistent with a correlation length that is diverging according to the critical exponent of the three-dimensional Ising model.

26523 Nicolai maps and fermion sectors. Claudson, M.; Halpern, M.B. (Center for Theoretical Physics, Department of Physics and Laboratory for Nuclear Science, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139; Department of Physics, University of California, Berkeley, California 94720). *Annals of Physics (New York);* **166**: No. 1, 33-75(Jan 1986). Contract AC02-76ER03069.

Nicolai maps, and particularly their fermion sector structure, are explored over a broad variety of supersymmetric theories. Studies are made in the Witten model, the N = 2 supersymmetric sigma model in 1+0 dimensions, dimensionally reduced Wess-Zumino models, and N = 1 Yang-Mills in D = 4. In general each theory yields families of Nicolai maps, each map being a Langevin equation, equivalent to the dynamics of a particular sector. We also detail the remarkable fact that closed form Nicolai maps exist for a few ordinary bosonic nonsupersymmetric theories, with ordinary QCD_4 as an important example. These bosonic theories correspond to "null-fermion" sectors of supersymmetric theories, in which the fermions fail to contribute.

6454 Field Theory

REFER ALSO TO CITATION(S) 26418, 26503, 26513, 26517, 26637, 26640, 26644

26524 (CBPF-MO—004/85) Introduction to the renormalization group study in relativistic quantum field theory. Mignaco, J.A.; Roditi, I. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1985. 69p. (In Portuguese). NTIS (US Sales Only), PC A04/MF A01. File Number DE86701472.

An introduction to the renormalization group approach in relativistic quantum field theories is presented, beginning with a little historical about the subject. Further, this problem is discussed from the point of view of the perturbation theory.

26525 (CBPF-NF—034/85) Fermionic loop wave functional for quantum chromodynamics at N sub(c) = + infinity. Botelho, L.C.L. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1985. 10p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701473.

A fermionic loop wave functional for euclidean QCD in the t'Hooft topological limit is considered. Arguments are given that

this equation leads to a fermionic (supersymmetric) string representation for the above theory.

26526 (CBPF-NF—045/85) Remarks on the triviality phenomena in lambda phi 4 - O(N)-field theory. Botelho, L.C.L. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1985. 12p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701474.

The lambda phi4-O(N)-field theory in random path space is formulated. By making use of this random path formulation, a probabilistic-topological argument is offered for the triviality phenomena of the quoted theory for D>4.

26527 (DESY—85-106) Quark and lepton masses in a six dimensional SO(12) model. Wetterich, C. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Oct 1985. 9p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86751125.

From International symposium on particles and the universe; Thessaloniki, Greece (1985).

I calculate Yukawa couplings in a six dimensional Einstein-Yang-Mills theory based on SO(12). I argue that the fermion masses may follow the pattern msub(t) >> msub(b), msub(c), msub(tau) >> msub(s), msub(μ) >> msub(d), msub(u), msub(e). (orig.).

26528 (DOE/ER/40213—1) Theory and phenomenology of strong and weak interaction high energy physics. Technical progress report, May 1, 1985-April 30, 1986. Thews, R.L.; Scadron, M.D.; Patrascioiu, A.; Sucipto, E. (Arizona Univ., Tucson (USA). Dept. of Physics). [1986]. Contract FG02-85ER40213. 7p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86008388.

Progress is reported in these areas: dynamical quark mass in QCD; quark s-d self energy in QFD; theory of nonleptonic weak decays; decays of heavy-quark mesons; quarks in nuclei; nonperturbative effects in non-abelian quantum field theory; whether perturbation theory is the asymptotic expansion in lattice gauge theories; and expanding in the gradient at weak coupling. 16 refs. (LEW)

26529 (INIS-mf—10074) Copenhagen interpretation versus Bohm's theory. Baumann, K. (Graz Univ. (Austria). Inst. fuer Theoretische Physik). 1985. 11p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701475.

The objections raised against Bohm's interpretation of quantum theory are reexamined, and arguments are presented in favour of this theory. Bohm's QED is modified such as to include Dirac particles. It is pointed out that the electric field may be chosen as the 'actual' field instead of the magnetic field. Finally, the theory is reformulated in terms of an arbitrary actual field.

26530 (KFKI—1985-60) On the thermodynamics of the vacuum. Diosi, L.; Lukacs, B.; Martinas, K.; Paal, G. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). Jul 1985. 17p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701477.

The fact that the energy-momentum tensor has nonzero vacuum expectation value in some space-times (the so-called back reaction) indicates a non-trivial thermodynamics of such vacua. A consequent thermodynamic analysis of the problem in Robertson-Walker space-times shows that in the generic case the number of the independent extensives is 2, in spite of the fact that the energy density is completely determined by the time evolution of the geometry after the preparation of the vacuum state. The appearance of a second independent extensive seems to be in direct connection with the extra entropy term in the Generalized Second Law of Bekenstein and Hawking.

26531 (OU-HET—76) Field theory of strings. Effective action for massless fields. Kikkawa, K. (Osaka City Univ. (Japan). Dept. of Physics). May 1985. 13p. NTIS, PC A02/MF A01. File Number DE86900006.

After giving a review for the field theory of string and the recent development in the superstring theory, the effective action for massless particles in the string theory is introduced. In the zero-slope limit the action is shown to reduce to the Einstein gravity theory with vanishing cosmological constant plus a massive dilaton term.

26532 (TRI—83-2) Six lectures on lattice field theory. Stone, M. (TRIUMF, Vancouver, British Columbia (Canada)). Nov 1983. 35p. (CONF-8305301—Exc.). NTIS (US Sales Only), PC A03/MF A01. File Number DE86901063.

From TRIUMF conference; Vancouver, Canada (24 May 1983).

These lectures are intended as an elementary introduction to some of the ideas of lattice quantum field theory for an audience already familiar with field theory in the continuum. Topics covered are: free and interacting scalar fields; continuum limit, restoration of rotational symmetry, and asymptotic freedom; fractals, scaling, and renormalization; gauge fields, Monte Carlo, and strong tension; fermions; and chiral symmetry breaking. 17 refs. (LEW)

26533 Gauge fields, quantum interference, and holonomy transformations. Anandan, J. (Max-Planck-Institut fuer Physik und Astrophysik, Werner-Heisenberg-Institut fuer Physik, D-8000 Munich 40, Federal Republic of Germany and Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physical Review* [*Section*] *D: Particles and Fields;* **33**: No. 8, 2280-2287(15 Apr 1986).

The question of which quantities are measured when a gauge field is experimentally detected is investigated. The Josephson effect is considered in connection with this question and a generalization of this effect for non-Abelian gauge theories is obtained. It is shown that the gauge field in an n-dimensional manifold can be reconstructed from the holonomy transformations (parallel-transport operators around loops) for an n-dimensional set of loops. An application is given to Minkowski space-time compactified by the addition of null infinity. An equivalence principle for gauge fields is also formulated.

26534 Gaussian effective potential. III. phi^6 theory and bound states. Stevenson, P.M.; Roditi, I. (T. W. Bonner Laboratories, Physics Department, Rice University, Houston, Texas 77251). *Physical Review* [*Section*] *D: Particles and Fields;* **33**: No. 8, 2305-2315(15 Apr 1986). Contract AS05-76ER05096.

Scalar theories with a λphi^4+ξphi^6 interaction are studied in 1+1 and 2+1 dimensions using the Gaussian-effective-potential method. Restrictions on the range of parameters are derived. In particular, the (2+1)-dimensional theory is unstable if the phi^6 coupling exceeds a critical value ξ/sub c/ = 0.255. For certain ranges of parameters the approximation indicates the existence of a two-particle bound state, and yields expressions for its mass and wave function.

26535 Ensemble projector Monte Carlo method, studying the lattice Schwinger model in the Hamiltonian formulation. Ranft, J.; Schiller, A. (Stanford Linear Accelerator Center, Stanford University, Stanford, California 94305). *Physical Review* [*Section*] *D: Particles and Fields;* **33**: No. 8, 2383-2387(15 Apr 1986). Contract AC03-76SF00515.

The ensemble projector Monte Carlo method is a promising method to study lattice gauge theories with fermions in the Hamiltonian formulation. We study the massive Schwinger model and show that consistent results are obtained in the presence of positive and negative matrix elements. The expectation values for the average energy calculated from matrix elements with negative and positive scores, and calculated from the average scores, are consistent with each other and with results obtained from the local Hamiltonian Monte Carlo method. In contrast with the latter method, the ensemble projector Monte Carlo method can be also applied to gauge field theories in 2+1 and 3+1 dimensions.

26536 Nonperturbative study of hadronization with heavy sources. II. Effects of flavor mutual screening in the two-species Schwinger model. Potvin, J. (Physics Department, University of Colorado, Boulder, Colorado 80309 and Physics Department, Brookhaven National Laboratory, Upton, New York 11973). *Physical Review [Section] D: Particles and Fields;* **33**: No. 8, 2388-2398(15 Apr 1986). Contract AC02-76CH00016.

We continue our study of the screening length L_0, the distance at which the interaction between heavy quarks begins to be screened as a result of light-quark pair production. We compute L_0 in the two-flavor Schwinger model and compare its mass dependence with the one-flavor case. Since the screening length is related to the binding energy of the dynamical fermions to the sources (heavy quarks), we use one-dimensional MIT bag ideas to discuss the effects of adding one more flavor to the problem. The results reported here have been obtained via a numerical simulation of the lattice Hamiltonian (ensemble projector Monte Carlo).

26537 Multigrid Monte Carlo method for lattice field theories. Goodman, J.; Sokal, A.D. (Courant Institute of Mathematical Sciences, New York University, 251 Mercer St., New York, New York 10012). *Physical Review Letters;* **56**: No. 10, 1015-1018(10 Mar 1986).

We propose a stochastic generalization of the multigrid method, which reduces critical slowing down in Monte Carlo computations of lattice field theories. For free fields, critical slowing down is completely eliminated. For a phi^4 model, numerical experiments show a factor of roughly-equal10 reduction, over a standard heat-bath algorithm, in the work needed to get a given accuracy (error-bar size).

26538 Gauge algebras in anomalous gauge-field theories. Niemi, A.J.; Semenoff, G.W. (Institute for Advanced Study, Princeton, New Jersey 08540). *Physical Review Letters;* **56**: No. 10, 1019-1022(10 Mar 1986). Contract AC02-76ER02220.

We show that in an anomalous gauge-field theory Faddeev's Schwinger term can be removed by a particular renormalization of the Gauss-law operators and we construct a positive-definite Hamiltonian that commutes with these renormalized operators.

26539 Expanding in the gradient at weak coupling. Patrascioiu, A. (Center for Nonlinear Studies, Los Alamos National Laboratory, Los Alamos, New Mexico 87545 and Physics Department, University of Arizona, Tucson, Arizona 85721). *Physical Review Letters;* **56**: No. 10, 1023-1026(10 Mar 1986).

A new method for producing the weak-coupling expansion in nonlinear σ models and Yang-Mills theories is developed. It assumes only the smallness of the gradient of the field, rather than of the field itself, as the coupling constant $1/\beta \to 0$. The new method reproduces all the known exact results. It agrees with ordinary perturbation theory only in Abelian problems or when the number of space-time dimensions $d \to \infty$. Notably the new scheme reveals that the O(N) nonlinear σ models in $d = 2$ are not asymptotically free; it also indicates that the leading term of the β function of QCD in four dimensions is likely different from its presently accepted value.

26540 Effective action in Monte Carlo calculations with dynamical fermions. Gavai, R.V.; Gocksch, A.; Ogilvie, M. (Department of Physics, Brookhaven National Laboratory, Upton, New York 11973). *Physical Review Letters;* **56**: No. 8, 815-818(24 Feb 1986).

We use the microcanonical demon method to determine nonpertubatively the renormalization of the gauge coupling constant as well as the effective magnetic field due to fermions within the framework of pseudofermionic simulations of finite-temperature QCD.

6455 Scattering Theory

26541 (LA—10620) Multiple scattering: a general formalism for small angles. Tschalaer, C. (Los Alamos National Lab., NM (USA)). Jan 1986. Contract W-7405-ENG-36. 15p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86007587.

This report outlines a general formalism for obtaining multiple-scattering distributions from single-scattering distributions in the small-angle approximation. The general formalism is based on Fourier transforms. Several special distributions are deduced from the general, energy-dependent, four-dimensional case. 3 refs.

26542 Self-consistent, Poincare-invariant and unitary three-particle scattering theory. Lindesay, J.V.; Markevich, A.J.; Noyes, H.P.; Pastrana, G. (Stanford Linear Accelerator Center, Stanford University, Stanford, California 94305). *Physical Review [Section] D: Particles and Fields;* **33**: No. 8, 2339-2349(15 Apr 1986). Contract AC03-76SF00515.

A Poincare-invariant formalism for the scattering of three distinguishable scalar particles is developed. Lorentz invariance in the form of velocity conservation and a parametric relation between the two- and three-body off-shell continuations in energy are introduced in order to satisfy unitarity and physical clustering. The three-body-invariant probability amplitude is derived from the two-body transition matrix elements.

26543 Angular momentum and spin within a self-consistent, Poincare-invariant and unitary three-particle scattering theory. Markevich, A.J. (Stanford Linear Accelerator Center, Stanford University, Stanford, California 94305). *Physical Review [Section] D: Particles and Fields;* **33**: No. 8, 2350-2356(15 Apr 1986). Contract AC03-76SF00515.

The self-consistent, Poincare-invariant and unitary three-particle scattering theory developed in a previous paper is extended to include angular momentum conservation and individual particle spin. The treatment closely follows that of the scalar case, with the complete set of angular momentum states for three free particles developed by Wick used in place of scalar plane-wave states.

65 PHYSICS II

6510 Nuclear Physics

REFER ALSO TO CITATION(S) 26778, 26788

26544 (INIS-mf—10082) Theory and computational science. Appendix to the Daresbury Annual Report 1984/1985. Durham, P. (Daresbury Lab. (UK)). 1985. 69p. NTIS (US Sales Only), PC A04/MF A01. File Number DE86701643.

The theoretical and computational science carried out at the Daresbury Laboratory in 1984/1985 is detailed in the Appendix to the Daresbury Annual Report. The Theory, Computational Science and Applications Groups, provide support work for the experimental projects conducted at Daresbury. Use of the FPS-164 processor is also described.

26545 (KFKI—1983-108) Revised version of the FEDGROUP-3 program system. Vertes, P. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). Nov 1983. 16p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86900862.

This report is a supplement to the report KFKI-1981-34 and describes the new improved version of FEDGROUP-3 code, a program system for processing evaluated nuclear data to constants for reactor physics. The preparation of the new version is based on the experiences of calculations performed in the last years and the code has been essentially improved from the point of view of accuracy and effectiveness.

26546 **(LA—10278-MS) Development plan for the Nucleon Physics Laboratory Facility at LAMPF.** McClelland, J.B.; Bacher, A.; Boudrie, R.L.; Carey, T.A.; Donahue, J.; Goodman, C.D.; McNaufhton, M.W.; Tanaka, N.; van Dyck, O.B.; Werbeck, R. (Los Alamos National Lab., NM (USA)). Feb 1986. Contract W-7405-ENG-36. 32p. NTIS, PC A03/MF A01; GPO Dep. File Number DE86008581.

A 3- to 4-year plan is described for upgrading the LAMPF Nucleon Physics Laboratory including a neutron time-of-flight facility for the (p,n) reaction, a medium-resolution spectrometer for (p,p') and n,p) studies, and a dedicated facility for atomic beam studies. Development of these facilities and relationships to other ongoing developments are detailed. The scope of the new physics programs supported by such a facility is discussed.

26547 **(LBL—20914) Dynamics of the dinucleus.** Randrup, J. (Lawrence Berkeley Lab., CA (USA); Nordita, Copenhagen (Denmark)). Jun 1985. Contract AC03-76SF00098. 20p. (CONF-850672—13). NTIS, PC A02/MF A01; GPO Dep. File Number DE86007422.

From 2. international conference on nucleus-nucleus collisions; Visby, Sweden (10 Jun 1985).

Damped reactions between heavy nuclei have revealed the temporary formation and evolution of a novel nuclear system, the dinucleus. This system possesses macroscopic degrees of freedom not present in the more ordinary mononucleus. Most important are: the energy associated with the relative dinuclear motion, the partition of the microscopic excitation energy (heat) and the total mass and charge among the two parts of the dinucleus, and their angular momenta. This paper briefly highlights the characteristic features of the dynamics of these dinuclear degrees of freedom and our current understanding of them. 19 refs., 3 figs.

26548 **(NP—6900939) IPEN scientific and technical publications. Jubilee edition, 1956-1981.** (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1981. 360p. NTIS (US Sales Only), PC A16. File Number DE86900939.

The present edition cites 1345 scientific documents published by the IPEN staff primarily in the fields of nuclear physics, radiochemistry, chemical engineering, nuclear metallurgy and engineering, and medical and industrial uses of radioisotopes. Author and subject indexes are included. (LEW)

26549 **(NP—6900943) RCNP annual report, 1981: April 1981-March 1982.** Fujita, Y.; Hosono, K.; Yamazaki, T. (eds.). (Osaka Univ., Suita (Japan). Research Center for Nuclear Physics). 1982. 276p. NTIS (US Sales Only), PC A13/MF A01. File Number DE86900943.

The cyclotron and the experimental facilities have operated reliably in the fiscal year 1981. A portion of the beam time for the polarized deuteron increased this year. Horizontally polarized deuteron beam was available for the experiments. The heavy ion beams accounted for nearly 20% of the whole beam time. The experimental work has been concentrating on high resolution studies via inelastic scatterings and transfer reactions. Almost half of the beam time was devoted to the experiments using the magnetic spectrograph RAIDEN. The main subjects of the nuclear research studied at RCNP in 1981 are as follows: (1) few-nucleon problems; (2) elastic and inelastic scattering of polarized protons and deuterons; (3) transfer reactions: (4) breakup of deuterons and ^{3}He; (5) giant multipole resonances; (6) hole and hole-analog states; (7) highly excited states and de-excitation processes; (8) spin excitations; (9) heavy ion reactions; and (10) beta decay. Researches in nuclear chemistry, engineering and medical science were also made. In the theoretical division much effort was directed to the analysis by three-body calculations in conjunction with the experiments done at RCNP. Two new experimental equipments built at a factory were delivered to RCNP and assembled. One is a triple-focussing mass separator called CARP to separate unslowed recoiling products in nuclear reactions. The other is a dual magnetic spectrograph called DUMAS to measure both the polarization and momentum of the scattered particles at the same time. The study of the future accelerator project at RCNP has been continued. In addition to the model magnet study, a full-scale model of the RF cavity was tested at low RF voltage level.

26550 **(UCID—18987-86) Report to the DOE Nuclear Data Committe, 1986.** Mathews, G.J.; Lanier, R.G. (Lawrence Livermore National Lab., CA (USA)). Feb 1986. Contract W-7405-ENG-48. 23p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86008147.

Brief summaries are given of 22 projects in the areas of nuclear data measurement, calculation, and evaluation. (LEW)

6511 Experimental Techniques

26551 **(CONF-8509260—1) Nuclear charge and isobar separation in a gas-filled enge split-pole magnetic spectrograph.** Henning, W. (Argonne National Lab., IL (USA)). 1985. Contract W-31-109-ENG-38. 8p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86007478.

From Workshop on feasibility of solar neutrino detection with /sup 205/T1 by geochemical and accelerator mass spectroscopical methods; Munich, F.R. Germany (22 Sep 1985).

The sepration technique is based on the fact that charge-changing processes of an ion in a gas, if they occur frequently enough in a magnetic field region, lead to trajectories determined by the average charge state of the ion in the gas. The technique has been used to separate isobaric ^{58}Ni and ^{58}Fe ions. 7 refs., 4 figs., 1 tab. (WRF)

26552 **(INFN/BE—84-10) New dipole resonances excited by radiative capture reactions: a proposal for NAC.** Zucchiatti, A. (Istituto Nazionale di Fisica Nucleare, Genoa (Italy)). 22 Oct 1984. 16p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86900961.

Work is proposed to exploit proton radiative capture (PRC) in an energy range from 25 MeV to 100 MeV to explore new dipole resonances. The proposal is supported by a brief review of what has been observed in PRC above the giant dipole resonance (GDR). Heavy ion radiative capture (HIRC) is viewed as an appropriate second generation experiment, and in support of this view, examples are given of new evidence shown by recent heavy ion capture experiments. The proposed experiments would use a gamma detector for energies up to 100 or 120 MeV, based on NaI (Tl). The data handling electronics are described. 15 refs., 9 figs. (LEW)

6512 Nuclear Properties And Reactions, A=1-5, Theoretical

26553 **(LA-UR—86-1054) Los Alamos free molecular and atomic tritium beta decay experiment.** Wilkerson, J.F.; Bowles, T.J.; Knapp, D.A.; Maley, M.P.; Robertson, J.F. (Los Alamos National Lab., NM (USA)). 1986. Contract W-7405-ENG-36. 20p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86008754.

An initial measurement of the tritium beta spectrum spanning an energy range of 16.4 - 18.9 keV has been performed using a free molecular tritium gas source. With the data from this preliminary low statistics measurement (~72 hours of data), we are able to set an upper limit on the electron-antineutrino mass of 36 eV at the 95% confidence level. Measurements with a gaseous source eliminate many of the ambiguities arising from uncertainties associated with solid-source-based measurements. The ultimate neutrino mass sensitivity of our system should be about 10 eV or less. 13 refs., 9 figs.

26554 **Pseudostate calculations in n+t and p+^{3}He systems.** Shen, P.N.; Tang, Y.C.; Kanada, H.; Kaneko, T. (School of Physics, University of Minnesota, Minneapolis, Minnesota 55455). *Physical Review* [*Section*] *C: Nuclear Physics;* **33**: No. 4, 1214-1220(Apr 1986). Contract AC02-79ER10364.

The specific distortion effect of the three-nucleon cluster in the n+t or p+ ^{3}He system is studied by using the pseudostate method in the resonating-group formulation. The result indicates that such an effect is significant mainly at low energies around the broad resonance in the Pauli-favored $1 = 1$ state. In the higher-energy region, a comparison between differential cross sections cal-

culated with and without distortion shows that this effect has only a minor influence.

26555 **Optical potential approach in scattering of hadrons from light nuclei.** Bleszynski, E.; Bleszynski, M.; Jaroszewicz, T. (Department of Physics, University of California, Los Angeles, California 90024). *Physical Review* [*Section*] *C: Nuclear Physics;* **33**: No. 4, 1228-1234(Apr 1986).

A new calculational approach is described which reproduces the Watson multiple scattering series, simplified by neglecting the terms describing the repeated scatterings of a projectile on the same target nucleon. The approach involves solving sets of uncoupled wave equations (Schroedinger or Dirac) with effective optical potentials of the analogous form as the first order optical potential used in the standard impulse approximation optical models. Our approach is particularly suitable in multiple scattering calculations for elastic scattering of hadrons from light nuclei. As an example of the application of the proposed method we evaluated multiple scattering series for the elastic scattering of protons from ^{4}He with the purpose of assessing the importance of relativistic effects in this reaction.

26556 **Capture of medium-energy positrons in deuterium.** Hwang, W.P. (Physics Department and Nuclear Theory Center, Indiana University, Bloomington, Indiana 47405). *Physical Review* [*Section*] *C: Nuclear Physics;* **33**: No. 4, 1370-1380(Apr 1986).

A formalism for investigating the positron-capture reaction e$^+$+d→nu-bar/sub e/+p+p at medium positron energy (i.e., 0.5—2.0 GeV) and small p-p excitation energies (i.e., E/sub rel/< or =10 MeV) is described. In view of the small p-p excitation energy E/sub rel/ being considered, we take into account only the $^1S_0$ and ^{3}P/sub J/ p-p final states (J = 0, 1, 2). For the polar vector current, an impulse approximation, modified to incorporate current conservation, is employed and additional meson-exchange currents are included in the dominant channel. For the axial vector current, the nucleon-only impulse approximation is used. Numerical results are presented to highlight the prospect of measuring the q^2 dependence of the nucleon axial form factor f/sub A/(q^2). The proposed precision measurement of the nucleon axial form factor may be feasible at the upcoming Continuous Electron Beam Accelerator Facility if the proposed positron ring can actually be constructed.

26557 **Measurement of the branching ratio ^{3}H(d,γ)/^{3}H(d,n) using thick tritium gas targets.** Morgan, G.L.; Lisowski, P.W.; Wender, S.A.; Brown, R.E.; Jarmie, N.; Wilkerson, J.F.; Drake, D.M. (Physics Division, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physical Review* [*Section*] *C: Nuclear Physics;* **33**: No. 4, 1224-1227(Apr 1986).

Measurements have been made of the branching ratio for the reactions ^{3}H(d,γ)^{5}He/^{3}H(d,n) ^{4}He for several incident deuteron energy ranges between 0 and 0.72 MeV. A stopping length tritium gas target bombarded by a pulsed deuteron beam was used to obtain a high reaction rate as well as provide neutron-gamma ray separation by time of flight. The branching ratio was determined to be 5.6 +- 0.6 x 10^{-5} integrated over the resonance from 0 to 275 keV.

6513 Nuclear Properties And Reactions, A=6-19, Theoretical

26558 (INIS-mf—10067, pp 35) **Scattering of antiprotons from nuclei.** Lichtenstadt, J. (Tel Aviv Univ., Israel. Dept. of Physics). 1984. NTIS (US Sales Only), PC A07/MF A01. File Number DE86780430. (CONF-8404290—Absts.).

From 30. anniversary meeting of the Israel Physical Society; Jerusalem, Israel (4 Apr 1984).

Bull. Isr. Phys. Soc. Vol. 30.

26559 **Experimental search for nonfusion yield in the heavy residues emitted in the ^{11}B+^{12}C reaction.** Mateja, J.F.; Frawley, A.D.; Parker, R.A.; Sartor, K. (Physics Department, Tennessee Technological University, Cookeville, Tennessee 38505). *Physical Review* [*Section*] *C: Nuclear Physics;* **33**: No. 4, 1307-1314(Apr 1986). Contract AS05-80ER10714.

The mechanism responsible for fusion cross section limitations in light heavy-ion systems has been the focus of numerous experimental and theoretical studies. Many of the experimental investigations have involved a study of the heavy residues emitted following the interaction of light heavy ions. One difficulty encountered in such studies is separating events from competing reaction mechanisms, such as direct transfer and incomplete fusion, from fusion-evaporation events. In the present work, direct and reverse reaction kinematics are exploited in an effort to determine the magnitude of the nonfusion strength in the heavy residue spectra for the interaction of ^{11}B and ^{12}C. It is particularly important that the ^{11}B+ ^{12}C fusion strength be properly identified, as it is the measured fusion strength in this entrance channel which in earlier studies clearly ruled out a fusion cross section limitation based upon having reached a critical density of compound nuclear states. In agreement with the earlier investigations, the present study reveals no significant nonfusion component in the heavy residue spectra for the ^{11}B+ ^{12}C reaction.

26560 **^{67}Li(π$^+$,pd)^3/sup ,/^{4}He reactions at 59.4 MeV.** Wharton, W.R.; Barnes, P.D.; Bassalleck, B.; Eisenstein, R.A.; Franklin, G.; Grace, R.; Maher, C.; Pile, P.; Rieder, R.; Szymanski, J. (Wheaton College, Wheaton, Illinois 60187). *Physical Review* [*Section*] *C: Nuclear Physics;* **33**: No. 4, 1435-1442(Apr 1986).

The (π$^+$,pd) reactions on ^{6}Li and ^{7}Li have been studied at T/sub π/ = 59.4 MeV. Triple- and single-differential cross sections for these reactions are presented. The data are fitted to a T matrix and compared to the ^{3}H(π$^+$,p)^{2}H reaction. A model in which the pion interacts and is absorbed on a "quasi-triton" cluster describes the main features of the data very well. An extrapolation of our data into unmeasured regions of phase space suggests that about 8% of the pion absorption cross section on ^{6}Li at 59.4 MeV goes into the (π$^+$,pd) channel. The ^{7}Li(π$^+$,pd)^{4}He(2$^-$) transition at 22.1 MeV excitation appears to be strongly populated. This is a surprise because it is not seen in the ^{7}Li(p,α)^{4}He reaction.

26561 **Elastic πi and π$^-$ scattering on ^{14}C at 164 MeV.** Harvey, C.J.; Baer, H.W.; Johnstone, J.A.; Morris, C.L.; Seestrom-Morris, S.J.; Dehnhard, D.; Holtkamp, D.B.; Greene, S.J. (University of Texas, Austin, Texas 78712). *Physical Review* [*Section*] *C: Nuclear Physics;* **33**: No. 4, 1454-1460(Apr 1986).

Differential cross sections for π^{+-} elastic scattering on ^{14}C at a pion kinetic energy of 164 MeV were measured over the angular range 20°—91°. A contaminant analysis was performed for the target sample based on the kinematic separation of the elastic scattering peaks and the use of previously measured or calculated elastic cross sections. The data are compared to a newly developed, momentum-space, optical-potential calculation which shows clearly the importance of including Pauli suppression and three-body kinematics in the microscopic scattering description.

6515 Nuclear Properties And Reactions, A=39-58, Theoretical

REFER ALSO TO CITATION(S) 26558

26562 **(INS—503) Cascade model analysis of the sideward 'Splash' in Nb+Nb collisions with high-multiplicity events.** Kitazoe, Y.; Furutani, H.; Toki, H.; Yamamura, Y.; Nagamiya, S.; Sano, M. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Aug 1984. 13p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701555.

A cascade model has been applied to a global analysis of high-multiplicity events in 400 MeV/nucleon Ca+Ca and Nb+Nb collisions. The global analysis gives a sideward peak in the angular

distribution of the high-multiplicity Nb+Nb events. Appearance of the peak is closely related to the development of cascade collisions from the participant region into the remaining (cold) region of the nuclei. The cascase development disturbs both the projectile and target nuclei, and induces the recoil motion of these nuclei, i.e. the bounceoff effect.

26563 **(ORNL/TM—9764) Study of radionuclides created by /sup nat/Ni(γ,xn yp) reactions for bremsstrahlung photons produced by 140-MeV electrons.** Dickens, J.K. (Oak Ridge National Lab., TN (USA)). Mar 1986. Contract AC05-84OR21400. 14p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86008480.

Twelve radionuclides from ^{48}V to ^{57}Ni produced by photon interactions with a sample of elemental Ni have been studied to obtain relative yields of these reaction products. Precision half lives were determined for ^{56}Ni and ^{57}Ni. For ^{56}Ni, T/sub 1/2/ = 6.08 +- 0.03 days, in agreement with previous measurements. For ^{57}Ni, T/sub 1/2/ = 35.54 +- 0.05 h, in agreement with the 1982 measurement of Grutter but ~ 0.5 h shorter than earlier measurements. relative yields of the 127-keV, 1758-keV, and 1919-keV gamma rays following decay of ^{57}Ni were determined with respect to the 1338-keV gamma ray of that decay and the results agree better with measurements of Grutter and of Gatrousis et al. than they do with the Lederer et al. evaluation.

26564 **Coupled-channel analysis of nucleon scattering from sup40Ca up to 80 MeV.** Honore, G.M.; Tornow, W.; Howell, C.R.; Pedroni, R.S.; Byrd, R.C.; Walter, R.L.; Delaroche, J.P. (Department of Physics, Duke University, Durham, North Carolina 27706 and Triangle Universities Nuclear Laboratory, Duke Station, Durham, North Carolina 27706). *Physical Review [Section] C: Nuclear Physics;* **33**: No. 4, 1129-1140(Apr 1986). Contract AC05-76ER01067.

Differential cross sections σ(theta) and analyzing powers A/sub y/(theta) for neutron scattering to the ground and first 3$^-$ excited state of ^{40}Ca have been measured in the energy range from 11 to 17 MeV. Elastic and inelastic scattering measurements have been obtained for A/sub y/(theta) at energies of 11.0, 13.9, and 16.9 MeV, the inelastic scattering data representing the first (n,n') measurements of A/sub y/(theta) for this nucleus. Differential cross sections for (n,n) and (n,n') have been obtained at 13.9 and 16.9 MeV. Both the σ(theta) and A/sub y/(theta) data at 13.9 MeV have been compared with previous measurements at this energy and the agreement is good, typically within less than 3%. These results have been combined with other σ(theta) and A/sub y/(theta) data and total cross section σ/sub T/ measurements to form a large set of scattering and reaction data for incident energies up to 80 MeV. This data set, along with σ(theta) and A/sub y/(theta) measurements available for proton scattering in this energy range, has been described in the framework of the coupled-channel formalism. This highly constrained analysis has led to a precise determination of geometries, energy dependencies, and deformation parameters.

26565 **Cross sections for the Ti(p,n) reaction to analogs of ground and 2$^+$ excited states.** Brown, V.R.; Wong, C.; Poppe, C.H.; Anderson, J.D.; Davis, J.C.; Grimes, S.M.; Madsen, V.A. (Lawrence Livermore National Laboratory, Livermore, California 94550). *Physical Review [Section] C: Nuclear Physics;* **33**: No. 4, 1235-1246(Apr 1986). Contract W-7405-ENG-48;AT06-79ER10405;AC02-76ER02490.

Cross sections for the (p,n) reaction to analog states have been measured for the five stable isotopes of titanium at energies between 11.5 and 26 MeV. In addition to the ground-state analogs, cross sections to the 2_1^+ analog states for the even A isotopes have been determined. A two-channel analysis of the ground-state analog data, searching on the charge-exchange parameters, did not yield a satisfactory globally consistent description of the 0_1^+ analog cross sections. However, in a full coupled-channel description of the 0_1^+ analog angular distributions the N-Z dependence and the strength of the 2_1^+ analog cross sections for /sup 46,48,50/Ti are explained by strong inelastic couplings and by rather different charge-exchange couplings among the three isotopes. The isovector deformation parameters used in the charge-exchange couplings were determined from electromagnetic and (p,p') values, which were obtained from experiment. The experimental energy dependence of the cross section shows a resonance behavior which is not explained by the channel coupling but which can be adequately accounted for by an energy dependent V_1.

26566 **Quasi-elastic processes in the ^{28}Si+^{40}Ca reaction at 225 MeV.** Vineyard, M.F.; Kovar, D.G.; Stephans, G.S.F.; Rehm, K.E.; Rosner, G.; Ikezoe, H.; Kolata, J.J.; Vojtech, R. (Argonne National Laboratory, Argonne, Illinois 60439). *Physical Review [Section] C: Nuclear Physics;* **33**: No. 4, 1325-1332(Apr 1986). Contract W-31-109-ENG-38.

Elastic, inelastic, and single-nucleon transfer data are reported for ^{28}Si+ ^{40}Ca at E/sub lab/ = 225 MeV. Standard optical model and distorted-wave Born approximation analyses of the elastic and inelastic scattering angular distributions have been performed resulting in good descriptions of the data. In the inelastic scattering analysis, the nuclear deformation lengths were found to be consistent with the Coulomb deformation lengths obtained from electron scattering. The data for one-nucleon transfers were analyzed using the distorted-wave Born approximation with the optical potential fitted to the elastic scattering and the spectroscopic factors taken from light-ion studies. With the exception of small shifts in angle, the distorted-wave Born approximation correctly predicts the shapes of the angular distributions and the relative intensities of transitions to different states populated in the same reaction. The magnitudes of the single-particle transfer cross sections are reproduced to within a factor of 1.5. However, the distorted-wave Born approximation fails to predict the nearly 40% difference in the magnitudes of the cross sections observed for the (^{28}Si, ^{27}Si) and (^{28}Si, ^{27}Al) reactions, which populate mirror states.

26567 **Nuclear data sheets for A = 57*.** Burrows, T.W.; Bhat, M.R. (National Nuclear Data Center, Brookhaven National Laboratory, Upton, New York 11973, U.S.A.). *Nuclear Data Sheets;* **47**: No. 1, 1-134(Jan 1986). Contract AC02-76CH00016.

The 1977 evaluation of A = 57 (77AU04) has been revised using experimental decay and reaction data received by the cutoff date noted below. See also 76Da02 for calculations related to the unobserved nuclides ^{57}Ti and ^{57}V.

6516 Nuclear Properties And Reactions, A=59-89, Theoretical

26568 **(ENEA-RT/FI—83-7) Importance of valence mechanism in neutron capture.** Reffo, G.; Fabbri, F.; Mengoni, A. (ENEA, Bologna (Italy). Dipartimento Tecnologie Intersettoriali di Base). Jan 1984. 6p. (CONF-8310228—2). NTIS (US Sales Only), PC A02/MF A01. File Number DE86900999.

From 6. Soviet national conference on neutron physics; Kiev, USSR (10 Oct 1983).

The role and the importance of the valence mechanism in neutron capture are illustrated at the example of the neutron radiative capture calculation at 30 keV on ^{86}Kr.

26569 **Nuclear data sheets for A = 65*.** Ward, N.J.; Tuli, J.K. (University of Liverpool, Liverpool, U. K.). *Nuclear Data Sheets;* **47**: No. 1, 135-251(Jan 1986).

Nuclear structure data on A = 65 nuclides have been reviewed. Results from reaction and decay data studies are presented together with adopted level and transition properties.

6517 Nuclear Properties And Reactions, A=90-149, Theoretical

26570 (DOE/ER/40159—098) Decay of ^{145}Cs to levels of ^{145}Ba. Robertson, J.D.; Faller, S.H.; Walters, W.B.; Zganjar, E.F.; Gill, R.L.; Mach, H.; Piotrowski, A.; Dejbakhsh, H.; Petry, R.F. (Maryland Univ., College Park (USA). Dept. of Chemistry; Louisiana State Univ., Baton Rouge (USA). Dept. of Physics; Brookhaven National Lab., Upton, NY (USA); Texas A and M Univ., College Station (USA). Cyclotron Lab.; Oklahoma Univ., Norman (USA). Dept. of Physics and Astronomy). 1986. Contract AC02-76CH00016;FG05-84ER40159. 7p. (CONF-860442—1). NTIS, PC A02. File Number DE86007340.

From General meeting of the American Physical Society; Washington, DC, USA (28 Apr 1986).

An investigation of the β^- decay of the 0.59s ^{145}Cs was made at the TRISTAN on-line mass separation facility. The level scheme for ^{145}Ba has been constructed. The proposed spin and parity assignments are based upon transition multipolarities and ∂-∂ angular correlation measurements. 16 refs., 2 figs., 2 tabs.

26571 (JINR—D-7-84-736) Conference on experiments on heavy ion beams. Annotations of papers. (Joint Inst. for Nuclear Research, Dubna (USSR); Ceskoslovenska Akademie Ved, Rez. Ustav Jaderne Fyziky; Joint Inst. for Nuclear Research, Dubna (USSR)). 1984. 101p. (CONF-8409305—). NTIS (US Sales Only), PC A06/MF A01. File Number DE86780376.

From Conference on experiments on heavy ion beams; Varna, Bulgaria (13 Sep 1984).

Abstracts of individual items from the conference were prepared separately for the data base. (GHT)

26572 (NEANDC(J)—119/U) Evaluation of resonance parameters of Mo, Tc, Te, Ba, La, Ce, Pr, Nd, Pm, Sm and Eu isotopes for JENDL-2 fission product file. Kikuchi, Yasuyuki; Togawa, Orihiko; Nakagawa, Tsuneo. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). Mar 1986. 246p. (JAERI-M—86-030; INDC(JPN)—105/L). JAERI, Tokai-mura, Naka-gun, Ibaraki-Ken 319-11, Japan. File Number TI86901088.

Neutron Nuclear Data of 100 fission product nuclei were evaluated for the second version of Japanese Evaluated Nuclear Data Library (JENDL-2) by Working Group on fission Product Nuclear Data in Japanese Nuclear Data Committee. As a part of this work, the resonance parameters were evaluated by a subworkig group on the basis of the recently measured data. In this report the evaluation work is described for ^{92}Mo, ^{94}Mo, ^{95}Mo, ^{96}Mo, ^{97}Mo, ^{98}Mo, ^{100}Mo, ^{99}Tc, ^{128}Te, ^{134}Ba, ^{135}Ba, ^{136}Ba, ^{137}Ba, ^{138}Ba, ^{139}La, ^{140}Ce, ^{142}Ce, ^{144}Ce, ^{141}Pr, ^{142}Nd, ^{143}Nd, ^{144}Nd, ^{145}Nd, ^{146}Nd, ^{148}Nd, ^{150}Nd, ^{147}Pm, ^{147}Sm, ^{148}Sm, ^{149}Sm, ^{150}Sm, ^{151}Sm, ^{152}Sm, ^{154}Sm, ^{151}Eu, ^{152}Eu, ^{153}Eu, ^{154}Eu and ^{155}Eu. The general evaluation procedure is described. The evaluation for each nuclide is described. The summary of the present results are given as well as the calculated thermal cross sections and resonance integrals. The presently evaluated parameters are given in Appendix with the measured data.

26573 Magnetic moments of the $(3/2)_1$p and $(5/2)_1^-$ states in /sup 107,109/Ag. Ballon, D.; Niv, Y.; Vajda, S.; Benczer-Koller, N.; Zamick, L.; Leander, G.A. (Department of Physics, Rutgers University, New Brunswick, New Jersey 08903). *Physical Review [Section] C: Nuclear Physics;* **33**: No. 4, 1461-1470(Apr 1986). Contract AC05-76OR00033.

The ratios of g factors of the first excited states of the /sup 107,109/Ag isotopes, g((3/2))/g((5/2)) = 1.5(3) and 2.3(5), respectively, have been measured by the perturbed angular correlation transient field technique. The absolute magnitudes of the g factors have been obtained through a calibration procedure that makes use of the magnetic dipole moments of the first 2^+ states of ^{106}Pd and ^{110}Cd and are ^{107}Ag: g($(3/2)_1^-$) = 0.61(12), g($(5/2)_1^-$) = 0.41(7) and ^{109}Ag: g($(3/2)_1^-$) = 0.66(10), g($(5/2)_1^-$) = 0.29(6). These results are compared with weak coupling calculations as well as with Nilsson models with symmetric or triaxial cores. The latter reveal a sensitive dependence of the g factors on the deformation parameter γ. .AE

26574 Evidence for h/sub 11/2/ neutron alignment in band crossings for the transitional mass 100 nuclei. Haenni, D.R.; Dejbakhsh, H.; Schmitt, R.P.; Mouchaty, G. (Cyclotron Institute, Texas A&M University, College Station, Texas 77843). *Physical Review [Section] C: Nuclear Physics;* **33**: No. 4, 1543-1546(Apr 1986).

In-beam γ-ray spectroscopy in concert with both massive transfer and fusion reactions has been used to study high-spin states in the relatively neutron-rich ^{102}Ru and adjacent mass 100 transitional nuclei. Backbending in ^{102}Ru is shown to result from the alignment of a pair of h/sub 11/2/ neutrons. Blocking arguments and cranked shell model calculations support this. Alignment of a pair of h/sub 11/2/ neutrons in the g/sub 9/2/ proton band of ^{103}Rh changes the signature splitting and B(M1)/B(E2) ratios.

6518 Nuclear Properties And Reactions, A=150-189, Theoretical

REFER ALSO TO CITATION(S) 26589

26575 (CONF-860270—2) Neutron emission prior to fission. Gavron, A.; Gayer, A.; Boissevain, J.; Britt, H.C.; Nix, J.R.; Sierk, A.J.; Grange, P.; Hassani, S.; Weidenmueller, H.A.; Beene, J.R. (Los Alamos National Lab., NM (USA); Strasbourg-1 Univ., 67 (France); Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.); Oak Ridge National Lab., TN (USA); Georgia State Univ., Atlanta (USA)). 1986. Contract W-7405-ENG-36;AC05-84OR21400. 4p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86008241.

From 4. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (24 Feb 1986).

Neutron emission in the ^{159}Er composite system is studied in order to investigate particle emission with energy spectrum and angular distribution in excess of statistical model predictions. Data are analyzed using a modified statistical model which incorporates effects due to nuclear dissipation, and also calculates neutron emission during the descent from the saddle to the scission point. Calculations consider the Kramers effect and the Transient effect. It is concluded that a detailed interpretation of enhanced neutron emission preceding fission in compound nucleus reactions is possible, and that an upper limit may be set on the reduced nuclear dissipation coefficient. 5 refs., 2 figs. (LEW)

26576 (DOE/ER/45200—2) Inelastic scattering in condensed matter with high intensity Mossbauer radiation. Annual report, March 1, 1985-February 28, 1986. Yelon, W.B.; Schupp, G. (Missouri Univ., Columbia (USA). Research Reactor Facility). Feb 1986. Contract FG02-85ER45200. 9p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86007007.

The past year has seen the completion of most of the design and construction phases of our instrument development and the beginning of our scientific investigations. Many technical difficulties relating to mechanical strains in the source cryostat and in the MICE detector assembly caused by cycling them between 300 and 100 K have been overcome. The scientific work has been highlighted by the performance of the MICE director and how it has allowed us to measure the asymmetry parameters in ^{183}W and ^{182}W much more reliably than in the past and by the high momentum resolution made possible with our intense sources as demonstrated by studies on Si. Quasielastic scattering in a liquid metal is planned as well as investigation of interference and time reversal parameters in ^{182}W (100 keV), ^{183}W (46.5 keV), ^{197}Au (77 keV), and ^{193}Ir (73 keV). Additional work on the TaS_2 1T using the 46.5 keV transition in ^{183}W is also planned in an effort to explore the already-observed anomaly at the 79°C incommensurate to quasi-commensurate transition.

26577 (INIS-mf—9864) Fission at high angular momenta. Buergel, M. (Freie Univ. Berlin (Germany, F.R.). Fachbereich Physik). 8 Nov 1984. 66p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE86751092.

By studies on the system $^{40}Ar+^{165}Ho$ by means of selected measuring methods which made a differential selection of certain angular momentum ranges and by this a discrimination between "fast fission" and compound-nucleus fission possible the validity of fundamental predictions of the model of the "fast fission" hitherto experimentally no yet confirmed was studied: 1) At the turning point of the trajectory for "fast fission" calculated by Gregoire the corresponding shape of which must be responsible for the angular distribution the centers of the two fragments must be separated by about 11 fm. 2) The widths of the mass distributions after "fast fission" and compound-nucleus fission must be different by a factor 2. The measurements of the angular dependence showed that both prediction cannot be simultaneously brought into accordance with the experimental results. The results of coincidence measurements between fission fragments and alpha particles confirmed the assumption mentioned under topic 2. The analysis of the angular dependence then yielded for the shape of the nuclear complex leading to "fast fission" a more compact shape than that indicated by Gregoire, namely with a distance of the fragments of about 7 fm. (orig.).

6519 Nuclear Properties And Reactions, A=190-219, Theoretical

26578 (GSI—85-22) Angular distributions in reactions with fast fission. Luetzenkirchen, K. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). Oct 1985. 116p. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE86751115.

In the nuclear reactions ^{50}Ti, $^{56}Fe + ^{208}Pb$ the angular distributions of reaction products were measured. The detection pursued via the K X-ray quanta of beta-unstable product nuclei emitted after electron capture and internal conversion. The differential distributions change their shape in dependence on the nuclear charge number Z. They are generally not symmetric around THETA=90°; an exception are only the fragments with charges Zapprox.=Zsub(sym)=Zsub(total)/2. Thus the distributions are not compatible with the production of the fragments by fission of a long-lived compound nucleus equilibrated in all degrees of freedom; rather they are the result of a new reaction type ('fact fission'), which equalizes the mass asymmetry of projectile and target in the time framework of the rotational period. A method is described which permits to determine the variance of the tilting angular momentum K_0^2 for the first time also from asymmetric angular distributions. K_0^2 is then no longer the variance of a distribution in the statistical equilibrium but characterizes the excitation of the tilting mode dynamically excited during the reaction. The results suggest that the tilting mode in the fast fission is only partly excited. The results are compared with the sum of the variances of all statistical rotational modes of a double-nucleus which are accessible via the measurement of γ multiplicities. Furthermore by means of a folding method from the angular distributions for each Z the mean rotational angle was determined by which the reaction complex has been rotated between formation and decay. From these rotational angles a time scale for the dynamical development of K_0^2 can be derived. The times lie in the range from $6x10^{21}$ s to $13x10^{21}$ s and are therefore of the same order of magnitude as the relaxation time for the mass drift. (orig./HSI).

26579 Test of the triaxial rotor model and the interacting boson fermion approximation model description of collective states in ^{191}Ir. McGowan, F.K.; Johnson, N.R.; Lee, I.Y.; Milner, W.T.; Roulet, C.; Hattula, J.; Fewell, M.P.; Ellis-Akovali, Y.A.; Diamond, R.M.; Stephens, F.S. (Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831). *Physical Review [Section] C: Nuclear Physics;* **33**: No. 3, 855-866(Mar 1986). Contract AC05-84OR21400;AS05-76ER04936;AC03-76SF00098.

Coulomb excitation of states in ^{191}Ir up to J = (21/2) has been observed with 160-MeV ^{40}Ar and 617-MeV ^{136}Xe ions. Most of these states are grouped into three rotational-like bands based on the $(3/2)^+$ ground state, the $1/2^+$ first excited state, and the $(7/2)^+$ γ-vibrational-like state at 686 keV. The average deviation between experimental and theoretical energies for 20 states is 45 keV for the particle-asymmetric-rigid-rotor model and 125 keV for the interacting boson fermion approximation model [limited to broken Spin(6) symmetry, and only the d/sub 3/2/ orbital is considered]. The overall agreement of both model predictions with experimental γ-ray yields for transitions within the $(3/2)^+$ band is quite good. For interband transitions originating in the $K = 1/2^+$ and $(7/2)^+$ bands, the interacting boson fermion approximation model tends to underestimate the γ-ray yields by one to two orders of magnitude. These six moderately collective transitions correspond to $\Delta tau_i = 2$ transitions in the U(6/4) and U(6/20) supersymmetry schemes and are strictly forbidden in these schemes. For both supersymmetric schemes there is a lack of detailed agreement with the very collective E2 transitions which have $\Delta tau_i = 0, +- 1$. The triaxial rotor model description of the experimental energies and the collective E2 transitions is the most successful approach. The B(E3) for excitation of several negative-parity states in ^{191}Ir is (4 +- 1)B(E3)/sub sp/.

6520 Nuclear Properties And Reactions, A=220 And Above, Theoretical

26580 Actinide production in reactions of heavy ions with ^{248}Cm. Moody, K.J.; Lee, D.; Welch, R.B.; Gregorich, K.E.; Seaborg, G.T.; Lougheed, R.W.; Hulet, E.K. (Nuclear Science Division, Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Physical Review [Section] C: Nuclear Physics;* **33**: No. 4, 1315-1324(Apr 1986). Contract AC03-76SF00098.

Transfer reactions of heavy ions with ^{248}Cm targets are evaluated for their usefulness in producing unknown neutron-rich actinide nuclides. Cross sections for the production of nuclides in the region 91< or =Z< or =100 were determined radiochemically from bombardments with ^{18}O, ^{86}Kr, and ^{136}Xe ions. The systematic trends in the cross sections for these reactions can be understood in terms of the Coulomb potential and the stabilizing effect of the reaction Q values, which tend to favor the production of nuclei with Z>Z/sub target/ with low excitation energies. Extrapolation of the product yields into unknown regions of charge and mass indicates that the use of heavy-ion transfer reactions to produce new neutron-rich above-target species is limited. Substantial production of unknown neutron-rich below-target species is expected in reactions with heavy projectiles like ^{136}Xe and ^{238}U.

26581 Transfer cross sections from reactions with ^{254}Es as a target. Schadel, M.; Bruechle, W.; Bruegger, M.; Gaggeler, H.; Moody, K.J.; Schardt, D.; Suemmerer, K.; Hulet, E.K.; Dougan, A.D.; Dougan, R.J. (Gesellschaft fuer Schwerionenforschung, D-6100 Darmstadt, Federal Republic of Germany). *Physical Review [Section] C: Nuclear Physics;* **33**: No. 4, 1547-1550(Apr 1986). Contract W-7405-ENG-48.

We report radiochemically determined cross sections for the heaviest known actinides produced in transfer reactions of /sup 16,18/O and ^{22}Ne with ^{254}Es as a target. A comparison with data for similar transfers from ^{248}Cm targets is made. Transfer cross sections are extrapolated for the production of the unknown, neutron-rich isotopes of elements 101 through 105, and the unique potential of ^{254}Es as a target to make these exotic nuclei accessible is demonstrated.

6530 Nuclear Theory

REFER ALSO TO CITATION(S) 26346, 26519, 26555, 26560

26582 (CONF-860158—1) Response of hot nuclei. Broglia, R.A. (Niels Bohr Inst., Copenhagen (Denmark); Observatoire de Paris, Section de Meudon, 92 (France); Milan Univ. (Italy). Ist. di Fisica). 1986. Contract AS05-76ER04936. 33p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86007867.

From 25. international meeting on nuclear physics; Bormio, Italy (20 Jan 1986).

The dipole giant resonance is reviewed, as it is the only vibration which has been experimentally identified in the decay of hot nuclei. The mechanism of exciting the resonance and the mode of the resonance are described. The methods used to calculate the vibrations from the shell model are discussed, including the Hartree-Fock approximation and random phase approximation. Nuclei formed by compound nuclear reactions, which possess high excitation energy and angular momentum, are considered. It is argued that the stability of the dipole may be used to advantage in the study of other properties of nuclei at high excitation. It is also considered possible that the discussion of the dipole giant resonance may be extended to the gamma decay of the isovector quadrupole vibration. 26 refs., 18 figs. (LEW)

26583 **(CONF-860270—3) Statistical description of orbiting and fusion.** Ayik, S.; Shivakumar, B.; Shapira, D.; Harmon, B.A. (Tennessee Technological Univ., Cookeville (USA); Oak Ridge National Lab., TN (USA)). 1986. Contract AC05-84OR21400. 4p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86008238.

From 4. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (24 Feb 1986).

An extension of the diffusion model is proposed for describing the intermediate processes and the compound nucleus formation in heavy ion collisions. The model describes the intermediate processes and fusion in terms of the formation and the evolution of long-lived dinuclear molecular complex (DMC) and its subsequent decay by fragmentation. The colliding ions can be trapped into the pocket of the entrance channel nucleus-nucleus potential and a DMC is formed. This DMC acts as a doorway state towards formation of a completedly equilibrated compound nucleus. It evolves through the exchange of nucleons to different dinuclear configurations. At each stage of its evolution, there is a finite probability to emit fragments into outgoing channels by thermal penetration over the barrier. The doorway states that do not fragment relax into a compound nucleus configuration and are identified as the fusion yield. The model is applied to the analysis of Si + C collisions for which the fusion cross section and the orbiting data are available for a wide range of bombarding energies. 7 refs., 2 figs. (LEW)

26584 **(CONF-860396—1) Formation of a dinuclear complex in collisions between light nuclei and entrance channel limitations to fusion.** Shapira, D.; Shivakumar, B.; Ayik, S.; Harmon, B.A. (Oak Ridge National Lab., TN (USA); Yale Univ., New Haven, CT (USA). Nuclear Structure Lab.; Tennessee Technological Univ., Cookeville (USA); Virginia Univ., Charlottesville (USA). Dept. of Physics). 1986. Contract AC05-84OR21400. 8p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86008530.

From Symposium on the many facets of heavy ion fusion reactions; Argonne, IL, USA (24 Mar 1986).

A model is described which addresses both the binary decay and the fusion of a dinuclear complex formed in the collision, and the model predictions are compared with data. In the model, the colliding ions can be trapped into the pocket of the entrance channel potential and a rotating dinuclear complex (DNC) is formed. The DNC evolves through the exchange of nucleons to different dinuclear configurations. At each state of its evolution there is a finite probability for the DNC to decay into two fragments. That part of the flux which does not decay into dinuclear channels (two separate nuclei) ends up fusing. 15 refs., 9 figs. (LEW)

26585 **(DOE/ER/10397—4) Theory of photon and electron induced reactions. Progress report, July 1, 1985-June 30, 1986.** Onley, D.S.; Wright, L.E. (Ohio Univ., Athens (USA). Dept. of Physics and Astronomy). Mar 1986. Contract AC02-79ER10397. 12p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86007655.

Considerable progress has been made or studies have been completed on the following aspects of the general problem of electron and photon induced reactions: (1) virtual photon spectra applied to fission and (e,e'f); (b) photoproduction of mesons and application to nuclei and hypernuclei; (3) Coulomb corrections to the radiation tail; and (4) inelastic electron scattering. Each of these developments is reported. 22 refs.

26586 **(DOE/ER/10407—6) Theoretical nuclear reaction and structure studies using kaons and photons. Progress report, 1 January-31 December 1985.** Cotanch, S.R. (North Carolina State Univ., Raleigh (USA). Dept. of Physics). 1985. Contract AS05-79ER10407. 8p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86008420.

Significant research results are summarized in the areas of kaon electromagnetic production and continuum shell model studies of photonuclear reactions. Progress is also reported in the study of deuteron electrodisintegration through kaon production. A description is reported to have been obtained for selective targets and states involving the giant dipole resonance for low energy nucleon radiative capture. 9 refs., 2 figs. (LEW)

26587 **(ENEA-RT/FI—83-9) Model for the calculation of neutron cross sections for fusion neutronic.** Reffo, G. (ENEA, Bologna (Italy). Dipartimento Tecnologie Intersettoriali di Base). Jan 1984. 8p. (CONF-8310228—3). NTIS (US Sales Only), PC A02/MF A01. File Number DE86900997.

From 6. Soviet national conference on neutron physics; Kiev, USSR (10 Oct 1983).

The principle of conservation of total angular momentum has been introduced into the unified model for equilibrium and preequilibrium emissions. The model has been used to analyze angular distributions and emission spectra in typical reactions of interest in fusion technology.

26588 **(ENEA-RT/FI—83-10) Angular momentum conservation in precompound decay.** Reffo, G.; Fabbri, F.; Costa, C. (ENEA, Bologna (Italy). Dipartimento Tecnologie Intersettoriali di Base). Jan 1984. 17p. (CONF-8309377—1). NTIS (US Sales Only), PC A02/MF A01. File Number DE86900996.

From International conference on nuclear physics; Florence, Italy (29 Aug 1983).

The introduction of the principle of conservation of total angular momentum into the formalism in the unified exciton model is briefly illustrated. The results obtained exhibit a much more satisfactory agreement with the experimental results. However one still finds discrepancies which suggest the necessity of further refinements as indicated in the conclusions.

26589 **(GSI—85-55-Prepr.) Dissipative dynamics in the microscopic and macroscopic phase space.** Feldmeier, H. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). Oct 1985. 17p. (CONF-850914—1). NTIS (US Sales Only), PC A02/MF A01. File Number DE86751102.

From Phase space approach to nuclear dynamics meeting; Miramare, Trieste, Italy (30 Sep 1985).

Considerations about the dynamical evolution of the microscopic one-body Wigner function for fermions, which move close to a window in the single particle potential between two nuclei, lead to a prediction about the irreversible change of the macroscopic phase-space distribution for the relative momentum. From this friction and diffusion coefficients are derived which imbedded in a Brownian-movement type description allow to understand non-equilibrium features of heavy-ion scattering cross-sections. (orig.).

26590 **(INS—512) Scattering by bound nucleons.** Tezuka, Hirokazu. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Oct 1984. 18p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701556.

Scattering of a particle by bound nucleons is discussed. Effects of nucleons that are bound in a nucleus are taken as a structure function. The way how to calculate the structure function is given.

26591 (INS—516) Applicability of the concept of 'optimal' collective submanifold determined by the self-consistent collective-coordinate method. Long-time behavior of trajectories on 'optimal' collective submanifold. Hashimoto, Yukio; Marumori, Toshio; Sakata, Fumihiko. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Nov 1984. 36p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86701553.

The applicability of the concept of "optimal" collective submanifold determined by the self-consistent collective-coordinate (SCC) method is investigated by using a simple model Hamiltonian. Long-time behavior of the SCC-method trajectories on the optimal collective submanifold is analyzed by comparing the geometrical structure of the SCC-method trajectories with that of the time-dependent Hartree-Fock (TDHF) trajectories in terms of the Poincare-mapping method. The concept of the optimal collective submanifold determined by the SCC method turns out to be applicable for a fairly large domain of the TDHF manifold where the separatrix is not included, in the sense that it can represent an approximate time-averaged trajectory of the complicated TDHF trajectories.

26592 (IP-UT-TNP-Rep—1) Quantum theory of "maximal-decoupled" collective motion based on the invariance principle of the Schroedinger equation. Marumori, Toshio; Sakata, Fumihiko; Une, Tsutomu; Hashimoto, Yukio. (Tsukuba Univ., Sakura, Ibaraki (Japan). Inst. of Physics). Aug 1982. 13p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86900866.

A full quantum theory of "maximally-decoupled" collective motion is proposed. The essential idea is to develop a quantum theory which is capable by itself to determine a "maximally-decoupled" collective subspace as well as a "maximally-decoupled" collective Hamiltonian, on the basis of a fundamental principle called the invariance principle of the Schroedinger equation. 14 refs.

26593 (JINR—E-1-84-703) Investigation of inclusive processes $\pi A \rightarrow \pi X$ and πsup(-)$A \rightarrow$ Psub(backwards)X at 40 GeV/c. Abrosimov, A.T.; Albini, E.; Antipov, V.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems; Milan Univ. (Italy). Ist. di Fisica; Joint Inst. for Nuclear Research, Dubna (USSR)). 1984. 8p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701459.

From 22. International conference on High Energy Physics; Leipzig, German Democratic Republic (1984).

The study of the inclusive processe is peformed for nuclear targets: C, Al, Cu, Pb t 40 GeV/c. Inclusive spectra of negative pions are obtained in the region 0.1 <= xsub(F) <= 0.9. The results are compared with the quark model predictions. The process $\pi A \rightarrow$ Psub(backward)X is studied in the 0.3-1 GeV/c region of secondary protons. Invariant cross sections of proton flying out in the back hemisphere are measured for the 120 deg - 175 deg angle interval. The A-dependece of the invariant cross section for this process is discussed. 7 refs.; 7 figs.; 3 tabs.

26594 (KFKI—1985-77) Quark-gluon plasma formation in relativistic heavy ion collisions within the hydrodynamical description. Kaempfer, B.; Barz, H.W.; Lukacs, B. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). Aug 1985. 19p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701554.

Within the one-dimensional one-component fluid-dynamical description, the space-time picture of the quark-gluon plasma formation with finite rearrangement time during relativistic heavy ion collisions is studied. Maximum effect of the delayed deconfinement (e.g. very broad fronts separating hadron matter and plasma, strong extra entropy production and strong time dependence of the deconfined state) was found when the QCD-suggested conversion time was 1 fm/c. The change of the flow pattern is discussed as a possible sign of the deconfinement transition.

26595 (RIFP—473) Recent progress in molecular resonances. Abe, Yasuhisa. (Kyoto Univ. (Japan). Research Inst. for Fundamental Physics). Apr 1982. 21p. (CONF-8112119—1). NTIS (US Sales Only), PC A02/MF A01. File Number DE86900880.

From Non-equilibrium statistical processes in nuclear reactions; Osaka, Japan (3 Dec 1981).

Several developments are briefly reviewed on the molecular resonances observed in lighter heavy ion reactions at energies well above the Coulomb barrier, which have been performed after the Band Crossing Model (BCM) was proposed. One of them is theoretical and experimental studies of magnetic substate population, which is directly related to the BCM. Another is a theoretical investigation of a fundamental assumption of the BCM, i.e., an existence of molecular bands and their crossings. A systematic understanding has been also developed on occurrence of resonance by inspecting the origins of absorption which might smear out resonance. 20 refs., 10 figs.

26596 (UCRL—94313) Semi-classical precompound decay models for heavy ion reactions of 10-100 MeV/nucleon. Blann, M. (Lawrence Livermore National Lab., CA (USA)). 1986. Contract W-7405-ENG-48. 22p. (CONF-860396—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86008759.

From Symposium on the many facets of heavy ion fusion reactions; Argonne, IL, USA (24 Mar 1986).

The hybrid and Boltzmann master equation, which predict heavy ion precompound decay phenomena, are investigated. These are both semi-classical approaches. The physical concepts of these two models are discussed, and their numerical formulations are summarized. Their success in reproducing experimentally measured (HI,n) spectra and in estimating limits on beam momentum transfer due to the precompound nucleon emission cascade are summarized. Results of calculations for subthreshold pion production are presented and compared with experimental yields. 19 refs., 5 figs. (LEW)

26597 Pion-nucleon charge exchange and scattering at low energies. Siegel, P.B.; Gibbs, W.R. (Theoretical Division, Los Alamos National Laboratory, Los Alamos, New Mexico 87545 and Physics Department, Arizona State University, Tempe, Arizona 85721). *Physical Review* [*Section*] *C: Nuclear Physics;* **33**: No. 4, 1407-1419(Apr 1986).

An analysis of low energy pion-nucleon charge exchange and elastic scattering data is presented. A system of coupled channels with nonlocal potentials is used to include the effects of the Coulomb interaction, pion and nucleon mass differences, and the photoabsorption channel. By using recent accurate charge exchange data, redundancies exist, allowing cross checks between data sets. The cross section for $\pi^+ n \rightarrow \pi^0 p$ is deduced and a value of $a_1 - a_3 = 0.290 +- 0.008\ \mu^{-1}$ is extracted.

26598 Nucleon-nucleon force in a skyrmion model stabilized by omega exchange. Eisenberg, J.M.; Erell, A.; Silbar, R.R. (School of Physics and Astronomy, Raymond and Beverly Sackler Faculty of Exact Sciences, Tel Aviv University, 69978 Tel Aviv, Israel). *Physical Review* [*Section*] *C: Nuclear Physics;* **33**: No. 4, 1531-1534(Apr 1986).

We consider a model of nucleon-nucleon interactions in which the nucleon is a Skyrme soliton stabilized by ω-meson exchange, rather than the usual quartic Lagrangian term. Making the product approximation for the meson field matrix U and an additive approximation for the ω field, we obtain nonzero, central, spin-spin, and tensor NN potentials. Their magnitudes, but not shapes, are sensitive to the ω coupling constant. In general, the results are similar to others obtained, using the same kinds of approximations, with the usual Skyrme Lagrangian. Neither approach finds intermediate-range attraction in the I = 0 central potential.

6540 Radiation And Shielding Physics

REFER ALSO TO CITATION(S) 25391

26599 (CTA-IEAV-NT—03/85) RECENT code with the Reich-Moore parametrization. Melnikoff, M.; Chalhoub, E.S.; Carlson, B.V. (Centro Tecnico Aeroespacial, Sao Jose dos Campos (Brazil). Inst. de Estudos Avancados). 1985. 12p. (In Portuguese). NTIS (US Sales Only), PC A02/MF A01. File Number DE86701640.

The program RECENT, which reconstructs neutron cross sections from resonance parameters given in the ENDF/B format, was modified in order to include in its structure the Reich-Moore parametrization.

26600 (ENEA-RT-TIB—84-25) Jacobi polynomials flux moments expansions and factorized kernel approach to the stationary integral anisotropic transport in a finite cylinder. Premuda, F.; Zucchini, A. (ENEA, Rome (Italy)). 1984. 85p. NTIS (US Sales Only), PC A05/MF A01. File Number DE86701549.

A transport method was developed in view of benchmark calculations of the eigenvalues and flux distributions for monoenergetic neutrons anisotropically colliding in a critical cylinder of finite radius and half-height. For the kernels appearing in the system of integral equations for spherical harmonic moments of the angular flux, we proposed a factorized form that accounted for the anisotropy of scattering and worked in the original Euclidean space, extending to cylinder geometry, of interest for pratical reactor calculations, a technique previously adopted for the simpler parallelepiped geometry. This treatment of the two-dimensional kernels allows representations typical in one dimensional problems for the matrix formulation to which the problem reduces by the introduction of a corresponding projectional technique. Optimal in view of an appropriate matrix formulation appears also the representation of the unknown spherical harmonics moments in terms of special jacobi polynomials, coinciding with a Legrendre polynomials expansion for the total flux in the case of isotropic scattering. The high accuracy of the results obtained in this case for both eigenvalues and fluxes is finally tested by internal convergence studies and heights as well as for the limiting cases or ratios of radius to height going to zero or to infinity.

26601 (INDC(CPR)—006/L) Measurement of neutron scattering cross sections at small angles. Qi, H.Q.; Liu, Y.C.; Chen, Z.P.; Wu, X.C.; Wang, W.H.; Zhang, J. (International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee). Aug 1985. 6p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701551.

A position sensitive neutron detector was used to measure the scattering cross sections of 14.7 MeV neutrons from Pb between 3° and 9°. The method to correct the effects of finite positional resolution by unfolding positional spectrum was studied.

26602 (JAERI-M—83-226, pp 10-13) Comment on the computer code for calculating ion range and energy deposition distribution. Fukuya, Koji. (Tokyo Univ., Japan. Faculty of Engineering). Jan 1984. (In Japanese). NTIS (US Sales Only), PC A06/MF A01. File Number DE86780432. (CONF-830197—).

From Workshop on computer simulation of atomic collision processes in solids; Tokyo, Japan (27 Jan 1983).

26603 (JAERI-M—83-226, pp 1-9) Extension of E-DEP-1 to high energy region. Aruga, Takeo. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). Jan 1984. (In Japanese). NTIS (US Sales Only), PC A06/MF A01. File Number DE86780432. (CONF-830197—).

From Workshop on computer simulation of atomic collision processes in solids; Tokyo, Japan (27 Jan 1983).

The radiation damage of materials by ion irradiation has been investigated. The E-DEP-1 code has been used to calculate the mean free path and straggling of implanted ions, and the distribution of damage energy. In this paper, the extension of this code to a high energy region is described. The LSS theory was applied to the electronic energy loss in a low energy region. The Sugiyama's formula was applied to the energy region up to 2 MeV/amu. For the energy region above 2 MeV/amu, the Ziegler's formula was used; thus, the E-DEP-1 code was extended. The depth distribution of the rate of nuclear energy loss was calculated with the E-DEP-1 code by using the residual range approximation of Kulcinski et al. and adding a routine of the distribution of sputtering damage rate. The calculated values of straggling by using the extended E-DEP-code was not in agreement with the experimental values. This may be due not to the neglect of the straggling but to electronic energy loss. Also, the assumption of Gauss distribution for the distribution of range was not proper. The asymmetric distribution, such as the Pearson's distribution, agreed well. However, the Kulcinski's approximation was good enough for the comparison in the linear scale.

26604 (JAERI-M—83-226, pp 14-20) Hydrogen isotope recycling problems in relation to radiation damage at wall surfaces in tokamaks. Sone, Kazuho. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). Jan 1984. (In Japanese). NTIS (US Sales Only), PC A06/MF A01. File Number DE86780432. (CONF-830197—).

From Workshop on computer simulation of atomic collision processes in solids; Tokyo, Japan (27 Jan 1983).

In the large tokamaks of JT-60 class aiming at attaining the critical condition of plasma, the long pulse operation is expected; accordingly, when neutral particle injection heating is used as the second stage heating, the particle density in plasma increases, and it is predicted that the stable operation cannot be maintained unless some measures are taken. Besides, in the next phase experimental fusion reactors, tritium as fuel particles permeates reactor walls, or increases inventory by being captured inside reactor wall materials. These problems are related to the recycling characteristics of plasma particles in wall materials among the interaction of plasma with walls. The recycling characteristics mean reflection, capture, permeation, disconnection, surface chemical reaction and so on related to the whereabouts of the plasma particles injected into walls. The diffusion, capture, permeation and so on are deeply connected to the degree of damage on the surface of or inside a material through which particles pass. The rate of re-emission which can be explained by a diffusion model and which cannot are described. In the wall materials with relatively large diffusion coefficient at the temperature of use such as stainless steel and molybdenum, it can be explained, but in the case of carbon, diffusion is not dominant.

26605 (JAERI-M—83-226, pp 21-43) Depth distribution of radiation damage and implanted ions by ion-irradiation into matters. Terasawa, Mititaka. (Toshiba Corp., Kawasaki, Kanagawa, Japan). Jan 1984. (In Japanese). NTIS (US Sales Only), PC A06/MF A01. File Number DE86780432. (CONF-830197—).

From Workshop on computer simulation of atomic collision processes in solids; Tokyo, Japan (27 Jan 1983).

The depth distributions of radiation damage and implanted ions by ion-irradiation into matters were investigated by collecting the published data and comparing with the theoretical results. The theoretical results have been obtained by using the E-DEP-1 code. The E-DEP-1 code is based on the Kulcinski's approximation. The mean free path and the straggling were obtained by the LSS theory. The application of the E-DEP-1 code is limited within some energy range. For example, the code can be applied for light ion irradiation less than several hundreds KeV. The electronic stopping cross sections in a higher energy region are corrected by using the experimental data. The data on the distribution of void swelling were collected. The depth where the void swelling is maximum was deeper than the peak depth of the damage curve by the E-DEP-1 code. The damage width around the peak of the E-DEP-1 damage curve was narrower than the experimental value. The void density was likely to agree with the results of E-EDP-1 code. The data on the distribution of point defects and point defect clusters were able to be well explained by the E-DEP-1 code. The data of range and straggling were compared with the calculated values. The agreement between the data and the calculated values was not good, and further study is required.

26606 (JAERI-M—83-226, pp 54-68) **Analyses of atomic-displacement cascades in solids by the multiple-collision method.** Taji, Yukichi. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). Jan 1984. (In Japanese). NTIS (US Sales Only), PC A06/MF A01. File Number DE86780432. (CONF-830197—).

From Workshop on computer simulation of atomic collision processes in solids; Tokyo, Japan (27 Jan 1983).

The phenomena of atomic displacement cascade in solids were analyzed by using multiple collision method. The computer code CASCMARL was used for the analysis. The simulation of cascade process caused by the incidence of one ion was made by the MARLOWE code and by the CLUSTER code. The size and position of holes and interstitial clusters were classified, and by the DAIQUIRI code, the simulation of the annihilation of the Frenkel pairs was made. Also, the random walk of isolated interstitial atoms was made. The depth of defects from the surface was plotted by using the PLOT routine. The Thomas-Fermi potential was used for the potential function of elastic scattering. The calculations were made for two cases. The one (Case A) is the 1 MeV carbon ion injection into pure iron, and the other (Case B) is the injection into iron with 1 percent carbon. The damage energy in Case B was less than that in Case A by 9.3 percent, and the defect number of Case B was also less than that of Case A by 6.9 percent. The results of simulation of the annihilation of a Frenkel pair and the random walk of an interstitial atom showed no difference between Case A and Case B. The depth distribution of defects showed that the depth in Case B was larger than that in Case A by 6.9 percent. Multiple collision method is required for the analysis of a system with a small amount of impurity.

26607 (JAERI-M—83-226, pp 69-81) **Annealing simulation of cascade damage using MARLOWE-DAIQUIRI codes.** Muroga, Takeo. (Tokyo Univ., Japan. Faculty of Engineering). Jan 1984. (In Japanese). NTIS (US Sales Only), PC A06/MF A01. File Number DE86780432. (CONF-830197—).

From Workshop on computer simulation of atomic collision processes in solids; Tokyo, Japan (27 Jan 1983).

The localization effect of the defects generated by the cascade damage on the properties of solids was studied by using a computer code. The code is based on the two-body collision approximation method and the Monte Carlo method. The MARLOWE and DAIQUIRI codes were partly improved to fit the present calculation of the annealing of cascade damage. The purpose of this study is to investigate the behavior of defects under the simulated reactive and irradiation condition. Calculation was made for alpha iron (BCC), and the threshold energy was set at 40 eV. The temperature dependence of annealing and the growth of a cluster were studied. The overlapping effect of cascade was studied. At first, the extreme case of overlapping was studied; then the practical cases were estimated by interpolation. The state of overlapping of cascade corresponded to the irradiation speed. The interaction between cascade and dislocations was studied, and the calculation of the annealing of primary knock-out atoms (PKA) in alpha iron was performed. At low temperature, the effect of dislocations was large, but the growth of vacancy was not seen. At high temperature, the effect of dislocations was small. The evaluation of the simulation of various ion irradiation and the growth efficiency of defects were performed.

26608 (JAERI-M—83-226, pp 82-95) **Monte Carlo simulation for theoretical calculations of damage and sputtering processes.** Yamamura, Yasunori. (Okayama College of Science, Japan). Jan 1984. (In Japanese). NTIS (US Sales Only), PC A06/MF A01. File Number DE86780432. (CONF-830197—).

From Workshop on computer simulation of atomic collision processes in solids; Tokyo, Japan (27 Jan 1983).

The radiation damage accompanying ion irradiation and the various problems caused with it should be determined in principle by resolving Boltzmann's equations. However, in reality, those for a semi-infinite system cannot be generally resolved. Moreover, the effect of crystals, oblique incidence and so on make the situation more difficult. The analysis of the complicated phenomena of the collision in solids and the problems of radiation damage and sputtering accompanying them is possible in most cases only by computer simulation. At present, the methods of simulating the atomic collision phenomena in solids are roughly classified into molecular dynamics method and Monte Carlo method. In the molecular dynamics, Newton's equations are numerically calculated time-dependently as they are, and it has large merits that many body effect and nonlinear effect can be taken in consideration, but much computing time is required. The features and problems of the Monte Carlo simulation and nonlinear Monte Carlo simulation are described. The comparison of the Monte Carlo simulation codes calculating on the basis of two-body collision approximation, MARLOWE, TRIM and ACAT, was carried out through the calculation of the backscattering spectra of light ions.

26609 (JAERI-M—83-226, pp 96-104) **Stopping power for heavy ions in low energy region.** Kitagawa, Mitsuo. (North Shore Coll., Atsugi, Kanagawa, Japan). Jan 1984. (In Japanese). NTIS (US Sales Only), PC A06/MF A01. File Number DE86780432. (CONF-830197—).

From Workshop on computer simulation of atomic collision processes in solids; Tokyo, Japan (27 Jan 1983).

The relation between the power for stopping heavy ions and the effective charge is described. The analysis of the nuclear stopping power is also presented. The analysis of stopping power by using the effective charge has been made by Anthony and Landford, and the results were compared with the experimental data. The obtained accuracy of the analysis was within +-10 percent. Ziegler et al. made the analysis in wide energy range, and compared the results with those of various ions. The accuracy of the analysis was within +-20 percent. The analysis of nuclear stopping power was made for various potentials, such as Thomas-Fermi, Moliere, Bohr, Kr-C, and the average potentials. An approximation method for the collision between different kinds of atoms was proposed. The deviation from the scaling law was also analyzed.

26610 **(JAERI-M—83-226) Report of workshop on computer simulation of atomic collision processes in solids.** Ozawa, Kunio; Iwata, Tadao. (Japan Atomic Energy Research Inst., Tokyo). Jan 1984. 112p. (In Japanese). (CONF-830197—). NTIS (US Sales Only), PC A06/MF A01. File Number DE86780432.

From Workshop on computer simulation of atomic collision processes in solids; Tokyo, Japan (27 Jan 1983).

Individual papers in this workshop report are abstracted separately. (LEW)

26611 **(JAERI-M—85-031) Analysis of time-of-flight experiment on lithium-oxide assemblies by a two-dimensional transport code DOT3.5.** Oyama, Yukio; Yamaguchi, Seiya; Maekawa, Hiroshi. (Japan Atomic Energy Research Inst., Tokyo). Mar 1985. 42p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86701552.

Calculational analyses were made on the time-of-flight experiment of neutron leakage spectra from lithium-oxide slabs. The uncertainties in the calculation due to modelling were examined and it was estimated to be 1-2%. The calculational results were compared with the experimental ones. The calculations were carried out by a two-dimensional transport code DOT3.5 using ENDF/B-4 nuclear data file. The comparison of energy-integrated fluxes in C/E made it clear that the tendency of discrepancy between both results depended on the thickness of assembly and leaking angle. The discrepancy of C/E was about 40% at the maximum. The effect due to the cross section change to a new data of $^{7}Li(n,n't)^{4}He$ was also examined. This type of comparison is useful for the systematic assessments. From the comparison, it was suggested that the angular distribution of secondary neutrons should be improved in the calculation, and the correct differential data of cross section are required.

26612 **(PB—86-162211/XAB) Technical activities 1985 - Center for Radiation Research.** Kuyatt, C.E. (National Bureau of Standards, Washington, DC (USA)). Oct 1985. 288p. (NBSIR—85/3232). NTIS, PC A13/MF A01.

The report summarizes research projects, measurement-method development, calibration and testing, and data-evaluation activities that were carried out during Fiscal Year 1985 in the NBS

Center for Radiation Research. These activities fall in the areas of atomic and plasma radiation, radiation physics, radiometric physics, radiation sources and instrumentation, ionizing radiation, and nuclear physics.

6550 Medical Physics

26613 (TNO-REP—1984, pp 3-6) **On-site neutron dosimetry intercomparison ENDIP-2.** Zoetelief, J.; Schraube, H. 1984. NTIS (US Sales Only), PC A14/MF A01. File Number DE86780442.

In REP annual report 1984.

A measuring team has visited a number of laboratories - which have connections with the Radiation Protection Program of the European Communities - to intercompare the dosimetry systems directly in the neutron fields actually employed for calibration in radiation protection and for radiobiology. Several national standardization institutes, including those in the USA, UK and FRG and the Bureau International des Poids et Mesures are in the process of setting up calibration facilities and are organizing intercomparisons. ENDIP-2 provides a connection between various intercomparison and standardization projects in Europe. Eighteen participating groups in six countries were visited in four sessions. The measurements in the neutron fields with the ENDIP-2 transfer dosimetry system were restricted to the reference conditions at the participating institutes, i.e. free-in-air, and/or at depth in phantom. When possible the tissue-equivalent ionization chamber systems were calibrated against the γ-ray sources which are used as reference by the participants.

26614 **(TNO-REP—1984) REP annual report 1984.** (Gezondheidsorganisatie TNO, Rijswijk (Netherlands). Radiobiologisch Inst. TNO; Gezondheidsorganisatie TNO, Rijswijk (Netherlands). Inst. voor Experimentele Gerontologie; Gezondheidsorganisatie TNO, Rijswijk (Netherlands). Primatencentrum). 1984. 311p. NTIS (US Sales Only), PC A14/MF A01. File Number DE86780442.

Individual papers in this annual report are separately abstracted. (LEW)

6560 Solid-state Physics

26615 **(CBPF-NF—012/85) Criticality of the D=2 quantum Heisenberg ferromagnet with quenched random anisotropic.** Mariz, A.M.; Tsallis, C. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1985. 15p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701487.

The square-lattice spin 1/2 anisotropic Heisenberg ferromagnet is considered, with interactions whose symmetry can independently (quenched model) and randomly be of two competing types, namely the isotropic Heisenberg type and the Ising one. Within a real space renormalization group framework, a quite precise numerical calculation of the critical frontier is performed, and its main asymptotic behaviour are established. The relevant universality classes are also characterized, through the analysis of the correlation length critical exponent.

26616 **(CBPF-NF—027/85) Anisotropic Heinsenberg surface on semi-infinite Ising ferromagnet: renormalization group treatment.** Costa, U.M.S.; Mariz, A.M.; Tsallis, C. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1985. 23p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701488.

A Migdal-Kadanoff-like renormalization group approach is used to study the critical behaviour of a semi-infinite simple cubic Ising ferromagnet whose (1, 0, 0) free surface contains anisotropic (in spin space) Heisenberg ferromagnetic interactions. The phase diagram presents three phases (namely the paramagnetic, the bulk ferromagnetic and the surface ferromagnetic ones) which join on a multicritical point. The location of this point is calculated as a function of the anisotropy. The various universality classes of the problem are exhibited.

26617 **(CBPF-NF—028/85) Anisotropic Heinsenberg interface between Ising bulk ferromagnets: a renormalization group approach.** Santos, R.J.V. dos; Sarmento, E.F.; Tsallis, C. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1985. 21p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701489.

Two semi-infinite spin 1/2 Ising media are considered (respectively characterized by the ferromagnetic coupling constants J_1 and J_2) separated by a spin 1/2 anisotropic Heisenberg interface (characterized by a ferromagnetic coupling constant J sub(S), and by a anisotropy eta epsilon [0, 1] in spin space; eta=1 and eta=0 respectively correspond to the Ising and isotropic Heisenberg limits). Within a real-space renormalization-group framework, the full phase diagram is discussed; this diagram exhibits, besides the paramagnetic phase, three physically different ordered phases, namely the double-bulk, single-bulk and surface ferromagnetic ones. The various universality classes appearing in this problem are also analized, and, in particular, the existence of a new high-order multicritical point associated with the $J_1 = J_2$ case is determined.

26618 **(CBPF-NF—032/85) Conductivity of a square-lattice bond-mixed resistor network.** Costa, U.M.S.; Tsallis, C.; Schwaccheim, G. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1985. 20p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701491.

Within a real-space renormalization-group framework based on self-dual clusters, the conductivity of a square-lattice quenched bond-random resistor network is calculated; the conductance on each bond being g_1 or g_2 with probabilities (1-p) and p respectively. The group recovers several already known exact results (including slopes), and is consequently believed to be numerically quite reliable for almost all values of p, and all ratios g_1/g_2 (in particular, $g_1=0$ and $g_1=$infinite with finite g_2 respectively correspond to the insulator-resistor and superconductor-resistor mixtures). In addition to that, an heuristic analytic expression is proposed for the conductivity which is believed to be a quite satisfactory approximation everywhere not too close to the percolation point.

26619 **(CBPF-NF—033/85) Z(4) model: criticality and break-collapse method.** Mariz, A.M.; Tsallis, C.; Fulco, P. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1985. 16p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701492.

Within a real-space renormalization group (RG) framework, the criticality of the Z(4) ferromagnet on square lattice is studied. The phase diagram (exhibiting ferromagnetic, paramagnetic and nematic-like phases) recovers all the available exact results, and possibly is a high precision one everywhere. In particular, the main asymptotic behaviours (bifurcation and Ising regions) are established. In addition to that, an operational procedure is developed (Break-collapse method) which considerably simplifies the exact calculation of arbitrary Z(4) two-terminal clusters (commonly appearing in RG approaches).

26620 **(CBPF-NF—050/85) Phase diagram of the Z(4) ferromagnet in anisotropic square lattice.** Tsallis, C.; Souletie, J. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro; Centre National de la Recherche Scientifique, 38 - Grenoble (France). Centre de Recherches sur les Tres Basses Temperatures). 1985. 25p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701494.

Within a real-space renormalisation-group (RG) scheme, the criticality of the ferromagnetic Z(4) model on anisotropic square lattice is studied. A RG cluster which has already proved to be very efficient for the Potts model on the same lattice is used. The establishment of the RG recurrence relations is greatly simplified through the break-collapse method. The phase diagram (exhibiting ferromagnetic, paramagnetic and nematic-like phases) recovers all the available exact results, and is believed to be a high precision one everywhere. If the model is alternatively thought as being associated with a particular hierarchical lattice rather than with the square one, then it is exact everywhere.

26621 (INIS-BR—425) Finite size studies of the Ashkin-Teller model. Alcaraz, F.C.; Felicio, J.R.D. de. (Sao Carlos Univ. (Brazil). Dept. de Fisica; Sao Paulo Univ., Sao Carlos (Brazil). Inst. de Fisica e Quimica). [1986]. 14p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701496.

The Ashkin-Teller model is studied in the time-continuous Hamiltonian version. Finite-size scaling is used to calculate the magnetic (γ sub(M)), electric (γ sub(P)) and thermal (α and σ) critical exponents for several values of the coupling constant (lambda). These results confirm the believed extended scaling relations and suggest a conjecture relating the mass-gap amplitudes and critical indices in the Hamiltonian context.

26622 (INIS-mf—10073) Fourth international conference on hot electrons in semiconductors. Program and abstract. (Innsbruck Univ. (Austria)). 1985. 135p. (CONF-850774—Absts.). NTIS (US Sales Only), PC A07/MF A01. File Number DE86701485.

From International conference on hot electrons; Innsbruck, Austria (8 Jul 1985).

100 papers were presented in 18 sessions on various experimental and theoretical aspects of hot electrons in semiconductors. 10 papers are within INIS scope and are treated individually.

26623 (KFKI—1982-51) Renormalization group study of the Hamiltonian version of the Potts Model III. Improved results for larger cells. Igloi, F.; Solyom, J. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). Jul 1982. 17p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86900852.

The renormalization group transformation applied earlier to the Hamiltonian Potts model to study the crossover from second-order to first-order transition as the number of states q increases is extended by taking larger cells in the block transformation. The results improve systematically with increasing block size. The critical value of q above which the transition is of first-order approaches 4, but the convergence is very slow. The classical equivalents of the new couplings, which drive the system to the first-order transition, are discussed.

26624 (LA-UR—86-1061) Grain growth phenomena in films: a Monte Carlo approach. Srolovitz, D.J. (Los Alamos National Lab., NM (USA)). 1986. Contract W-7405-ENG-36. 23p. (CONF-860495—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE86008755.

From International conference on metallurgical coatings; San Diego, CA, USA (7 Apr 1986).

A statistical model of microstructural evolution is developed for the evolution of grain structure during deposition. In cases where the atomic mobility on the surface greatly exceeds that in the bulk of the film, the bulk microstructure may be viewed as static while all of the evolution is controlled by the free surface. This leads naturally to a two-dimensional model of microstructural evolution. Since the surface is advancing at a constant rate during deposition there is a linear relationship between time in the two-dimensional model and depth in the film. A Monte Carlo computer simulation technique is described which models the evolution of microstructure in this way. Various driving forces are included. Simulated microstructures in the plane of the film and in the plane perpendicular to the free surface are shown.

26625 Hole-scattering mechanisms in modulation-doped heterostructures. Walukiewicz, W. (Center for Advanced Materials, Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Journal of Applied Physics;* **59**: No. 10, 3577-3579(15 May 1986). Contract AC03-76SF00098.

Hole mobilities in the two highest spin-split subbands in a p-type modulation-doped heterostructure are calculated. The light-hole mobility is shown to be very low because of efficient scattering by the holes in the heavy mass subband. This finding significantly simplifies calculation of the charge transport, since only the heavy-hole contribution has to be considered. It is shown that for the state-of-the-art heterostructures the heavy-hole mobility is limited by the deformation potential acoustical and optical phonon scatterings with small contribution from ionized impurities at low temperatures. The valence-band deformation potential constant has been determined comparing the theoretical calculations with available experimental data on temperature dependence of the hole mobility.

26626 Comparative study of model potentials for the calculation of dielectric properties of small metal particles. Ekardt, W.; Penzar, Z.; Sunjic, M. (Solid State Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831; Fritz-Haber-Institut der Max-Planck-Gesellschaft, Faradayweg 4-6, D-1000 Berlin 33, Federal Republic of Germany). *Physical Review [Section] B: Condensed Matter;* **33**: No. 6, 3702-3708(15 Mar 1986). Contract AC05-84OR21400.

Quite recently the dielectric electronic-response properties of small metal particles were investigated within a strictly self-consistent spherical jellium model. The bottleneck of this kind of calculation for a larger cluster is the self-consistent solution of the single-electron Kohn-Sham equations. Therefore, in this work simple model potentials are investigated and compared with the Kohn-Sham barrier. The result of this comparison is that the widely used model potentials such as finite- or infinite-step potentials are not able to mimic the complex dynamical behavior of a fully self-consistently responding surface.

26627 Hall conductivity and Lorentz force law for two-band semiconductors. Mitchell, D.L. (University of California, Berkeley, California 94720; Lawrence Berkeley Laboratory, Berkeley, California 94720). *Physical Review [Section] B: Condensed Matter;* **33**: No. 6, 4021-4026(15 Mar 1986). Contract AC03-76SF00098.

The intraband and interband contributions to the Hall conductivity are calculated for a two-band semiconductor. The interband contributions to the conductivity include a residual term at frequencies less than the band gap. The residual conductivity can be related to a spin-orbit component of the Lorentz force law, analogous to the relativistic case for electrons and positrons. The conductivity is shown to satisfy the proper sum rule.

26628 Vacancy and labeled-particle hopping with interactions. Richards, P.M. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Physical Review [Section] B: Condensed Matter;* **33**: No. 5, 3064-3075(1 Mar 1986). Contract AC04-76DP00789.

Classical hopping of interacting particles on a regular lattice is considered in a model where strong repulsions at the saddle point make hopping to a vacant site unfavorable unless there is another vacant site nearby. This picture may be appropriate to metal hydrides at large hydrogen concentration. Physical arguments, analytic theory, and results of simulations are presented. They show that labeled-particle motion is mean-field-like (single hopping rate given by average over distribution) but that vacancy motion takes place on two time scales: rapid motion for pairs of vacancies and much slower diffusion of vacancies which are isolated initially. This picture is in agreement with the different hopping rates in PdH/sub x/ inferred from ultrasonic attenuation and NMR, and can explain the large prefactor anomalies seen in proton NMR. Implications for other experiments such as the Gorsky effect, quasielastic neutron scattering, and NMR of the metal nucleus are discussed.

6561 Superconductivity

REFER ALSO TO CITATION(S) 25866, 25887, 25909

6570 Theoretical Physics

REFER ALSO TO CITATION(S) 26409, 26524, 26530, 26537

26629 (AD-A—163090/4/XAB) Force-free magnetic fields. Yang, W.H.; Antiochos, S.K.; Sturrock, P.A. (Stanford Univ., CA (USA). Center for Space Science and Astrophysics). Nov 1985. 29p. (CSSA-ASTRO—85-25). NTIS, PC A03/MF A01.

The problem under discussion is that of calculating magnetic field configurations in which the Lorentz force j x B is everywhere zero, subject to specified boundary conditions. The magnetic field is represented in terms of Clebsch variables in the form B = grad alpha x grad beta. These variables are constant on any field line so that each field line is labeled by the corresponding values of alpha and beta. When the field is described in this way, the most appropriate choice of boundary conditions is to specify the values of alpha and beta on the bounding surface. The author show that such field configurations may be calculated by a magneto-frictional method. They imagine that the field lines move through a stationary medium, and that each element of magnetic field is subject to a frictional force parallel to and opposing the velocity of the field line. This concept leads to an iteration procedure for modifying the variables alpha and beta, that tends asymptotically towards the force-free state. The method is applied first to a simple problem in two rectangular dimensions, and then to a problem of cylindrical symmetry, previously discussed by Barnes and Sturrock (1972). In one important respect, these new results differ from the earlier results of Barnes and Sturrock, and it is concluded that the earlier article was in error.

26630 **(CBPF-NF—031/85) Atomic ionization by strong electric fields: one dimensional model.** Antunes Neto, H.S.; Mello, J.C. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1985. 9p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701464.

An analytic expression for the gauge independent transition probability amplitudes is found for a one-dimensional Dirac-delta function potential at Strong Electric Fields.

26631 **(CBPF-NF—042/85) On a theory of gravitation in Minkowski space.** Oliveira, C.G. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1985. 10p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701470.

It is shown that a theory of gravitation in Minkowski space, proposed by Logunov et al., does not satisfy the well known results of the field in presence of a spherically symmetric distribution of matter (Schwarzschild field).

26632 **(CBPF-NF—043/85) On the solutions of the heat equation.** Malbouisson, A.P.C.; Rego Monteiro, M.A. do; Simao, F.R.A. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1985. 11p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701465.

It is shown, for a wide class of operators, that the solution to the corresponding heat equation may be obtained as a series. This is accomplished by the inverse Mellin transform the green functions of the complex power operator.

26633 **(CBPF-NF—052/85) Schroedinger equation for central power law potentials and the classical theory of ordinary linear differential equations of the second order.** Lima, M.L.; Mignaco, J.A. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1985. 55p. NTIS (US Sales Only), PC A04/MF A01. File Number DE86701466.

It is shown that the rational power law potentials in the two-body radial Schoedinger equation admit a systematic treatment available from the classical theory of ordinary linear differential equations of the second order. The admissible potentials come into families evolved from equations having a fixed number of elementary singularities. As a consequence, relations are found and discussed among the several potentials in a family.

26634 **(CBPF-NF—053/85) Isomorphism between matrices and quaternions.** Silveira, A. da. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1985. 9p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701467.

It is shown that the correspondence matrix-quaternion is such to each physical equation there corresponds a set of equivalent matrix equations.

26635 **(CONF-8509257—1) Theories without AB effect misrepresent the dynamics of the electromagnetic field.** Peshkin, M. (Argonne National Lab., IL (USA)). 1985. Contract W-31-109-ENG-38. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86007510.

From NATO workshop on fundamental aspects of quantum theory; Como, Italy (2 Sep 1985).

A summary of arguments as to why the Aharonou-Bohm effect (AB) cannot be removed from quantum mechanics without spoiling the conservation and quantization of angular momentum. 8 refs. (WRJ)

26636 **(CONF-8509257—2) Spins of cyons and dyons.** Lipkin, H.J.; Peshkin, M. (Argonne National Lab., IL (USA); Weizmann Inst. of Science, Rehovoth (Israel)). 1985. Contract W-31-109-ENG-38. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86007509.

From NATO workshop on fundamental aspects of quantum theory; Como, Italy (2 Sep 1985).

We examine the meaning of the angular momentum of cyons in some detail and compare the cyon case with the more familiar case of the dyon composed of a spinless electron bound by a scalar force to a spinless magnetic monopole. This treatment differs from others not primarily in its results, but in its central point that those results follow from very simple and general properties of the angular momentum in the electromagnetic field. 6 refs., 4 figs.

26637 **(DOE/ER/40215—T3) Obtaining the Einstein-Hilbert action from a superconformal theory.** Pilot, C.H. (Oklahoma State Univ., Stillwater (USA). Dept. of Physics). Jan 1986. Contract FG05-85ER40215. 41p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86009007.

By breaking the superconformal group it is possible to obtain an Einstein-Hilbert type action starting from one quadratic in the curvatures. The Newtonian gravitational constant is interpreted as a ratio of order parameters; at present low energies, these approach constant values of inherent dimension (much like the magnetization in a ferromagnet). Radiative corrections are forwarded as the mechanism responsible for S.S.B. 12 refs.

26638 **(IC—85/30) On the Casimir elements of Lie superalgebras.** Nwachuku, C.O. (International Centre for Theoretical Physics, Trieste (Italy)). Apr 1985. 11p. (CONF-8410309—5). NTIS (US Sales Only), PC A02/MF A01. File Number DE86701480.

From Symposium on the state of physics and mathematics in Africa; Trieste, Italy (8 Oct 1984).

A recursive relation (an algorithm) which expresses the eigenvalues Csub(p) of the Casimir operators of arbitrary order p of the orthosymplectic Lie superalgebra in terms of the Csub(p-1) plus a 'correction' term which is considerably easy to calculate is obtained. In the case of the general linear superalgebra the corresponding relation is trivial in a sense to be made precise. By going to the non-graded limits the corresponding results for the orthogonal and the symplectic groups, and the unitary group, respectively, are deduced.

26639 **(IFT-P—10/85) Quantum Mechanics in the Gaussian Wave-Packet Phase Space Representation: Dynamics.** Mizrahi, S.S. (Instituto de Fisica Teorica, Sao Paulo (Brazil)). 1985. 21p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701468.

The Heisenberg and Liouville dynamical equations are mapped using the Wave-Packet Phase Space Representation. A semiclassical perturbative expansion is introduced - the Quasi-Causal Approximation - for the Green function and an expression for transition probabilities is derived up to the first order.

26640 **(INFN/AE—85-4) Tachyons: may they have a role in elementary particle physics.** Recami, E.; Rodrigues, W.A. (Istituto Nazionale di Fisica Nucleare, Rome (Italy); Universidade Estadual de Campinas (Brazil). Inst. de Matematica). 1985. 20p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701471.

The possible role of space like objects in elementary particle physics (and in quantum mechanics) is reviewed and discussed, mainly by exploiting the explicit consequences of the peculiar relativistic mechanics of tachyons. Particular attention is paid: 1) to tachyons as the possible carriers of interactions ("internal lines"); e.g., to the links between "virtual particles" and superluminal objects; 2) to the possibility of "vacuum decays" at the classical level; 3) to a Lorentz-invariant bootstrap model; 4) to the apparent shape of the tachyonic elementary particles ("elementary tachyons") and its possible connection with the de Broglie wave-particle dualism.

26641 (INIS-BR—426) Supergravity. Oliveira Rivelles, V. de. (Paraiba Univ., Joao Pessoa (Brazil). Dept. de Fisica). 1985. 53p. (In Portuguese). NTIS (US Sales Only), PC A04/MF A01. File Number DE86701481.

The main aspects of the supergravity are presented. Several implications are discussed when the global symmetry is transformated in a local one. The supersymmetric Higgs mechanism as well as the Kaluza-Klein theory are also discussed.

26642 (INIS-mf—9866) Stochastic mechanics and the Kepler problem. Garbaczewski, P. (Forschungszentrum Bielefeld-Bochum-Stochastik (BiBoS), Bielefeld (Germany, F.R.)). Sep 1985. 17p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86751099.

BiBoS. No. 70.

Nelson - Guerra's stochastic mechanics is formulated for the hydrogen atom. We demonstrate that this simple quantum system can be described in terms of three independent Gaussian Markov processes, which are driven (controlled) by the classical Kepler problem. It reveals a manifest connection between the classical and quantized versions of the Kepler problem. (orig.).

26643 (LBL—20641) Microcanonical quantization and its applications. Iwazaki,A. (Lawrence Berkeley Lab., CA (USA)). Nov 1985. Contract AC03-76SF00098. 12p. (CONF-8411240—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE86005999.

From Symposium in honor of Professor Gyo Takeda's 60th birthday anniversary; Sendai, Japan (1 Nov 1984).

We discuss microcanonical quantization and its interesting properties and explain our recent proposal for a numerical application. 5 refs.

26644 (LBL—21046) Gauge-fields and integrated quantum-classical theory. Stapp, H.P. (Lawrence Berkeley Lab., CA (USA)). Jan 1986. Contract AC03-76SF00098. 14p. (CONF-860147—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86008373.

From Conference on new techniques and ideas in quantum measurement theory; New York City, NY, USA (21 Jan 1986).

Physical situations in which quantum systems communicate continuously to their classically described environment are not covered by contemporary quantum theory, which requires a temporary separation of quantum degrees of freedom from classical ones. A generalization would be needed to cover these situations. An incomplete proposal is advanced for combining the quantum and classical degrees of freedom into a unified objective description. It is based on the use of certain quantum-classical structures of light that arise from gauge invariance to coordinate the quantum and classical degrees of freedom. Also discussed is the question of where experimenters should look to find phenomena pertaining to the quantum-classical connection. 17 refs.

26645 (ON—02/83) Index defined by focal points for periodic Hamiltonian systems. Martins, R.V. (Observatorio Nacional, Rio de Janeiro (Brazil)). 1983. 16p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701469.

Associated to an n-dimensional linear Hamiltonian system, a real number μ is defined as the mean number of focal points per unit of time. For general one parameter families of Hamiltonian systems with periodic coefficients, the existence and the continuity of μ can be proved. Moreover, if the periodic system is hyperbolic, μ is associated to an integer. These results are extentions of Poincare's Study of Manpertuis' focal points.

26646 (TRI-PP—82-44) Light output optimization from various geometries of BGO crystals. Anderson, S.; Salomon, M. (TRIUMF, Vancouver, British Columbia (Canada)). Nov 1982. 3p. (CONF-821160—3). NTIS (US Sales Only), PC A02/MF A01. File Number DE86901071.

From International workshop on bismuth germanate; Princeton, NJ, USA (10 Nov 1982).

The different geometrical effects that determine the light output of BGO crystals are investigated. Several bulk shapes, attenuation lengths and reflectors are compared. The highest light output is obtained from trapezoids with specular reflecting walls. 2 refs., 1 fig., 1 tab.

26647 Method-of-moments solution of a parallel-plate waveguide aperture system. Jarem, J.M. (Department of Electrical Engineering, The University of Texas at El Paso, El Paso, Texas 79968). *Journal of Applied Physics;* **59**: No. 10, 3566-3570(15 May 1986).

The aperture fields which are excited in a ground-plane slot which is fed by a parallel-plate waveguide containing a TEM wave is solved by a K-space moment-method technique. The moment-method equations are derived using a boundary-value approach. A numerical example giving the matrix solution, aperture admittance, and electric field for the above waveguide-fed slot problem is presented. The far-field radiation pattern of the method-of-moments aperture field is calculated.

26648 Matrix methods in discrete-time quantum mechanics. Bender, C.M.; Simmons L.M. Jr.; Stong, R. (Department of Physics, Washington University, St. Louis, Missouri 63130). *Physical Review [Section] D: Particles and Fields;* **33**: No. 8, 2362-2366(15 Apr 1986).

The operator difference equations that arise in the finite-element treatment of a quantum theory are implicit and therefore difficult to solve. By introducing a matrix formulation it is possible to circumvent the implicit character of these equations and obtain explicit closed-form solutions for arbitrary matrix elements of any operator.

26649 Transfer equation in accelerated media. Munier, A. (Los Alamos National Laboratory, Los Alamos, New Mexico and Commissariat a l'Energie Atomique, Centre d'Etudes de Limeil, Paris, France). *Physical Review [Section] D: Particles and Fields;* **33**: No. 8, 2111-2120(15 Apr 1986).

The transfer equation for photons is obtained from the Lindquist formalism in curvilinear coordinates (no symmetry assumed), in an arbitrary frame and in any basis (natural or physical), to first order in O(v/c). Acceleration terms in the fluid are introduced via a modification of the metric tensor. The local tetrad attached to the accelerated fluid element follows a Fermi-Walker transport. Lorentz transformations are used to transform locally the equation from Lagrangian to Eulerian space-time coordinates. The resulting equation agrees in the case of a local Minkowskian space with the equation obtained directly using special-relativistic considerations.

26650 Singular perturbation approach to non-Markovian escape rate problems with state dependent friction. Dygas, M.M.; Matkowsky, B.J.; Schuss, Z. (Department of Engineering Sciences and Applied Mathematics, The Technological Institute, Northwestern University, Evanston, Illinois 60201). *Journal of Chemical Physics;* **84**: No. 7, 3731-3738(1 Apr 1986). Contract AC02-78ER04650.

We employ singular perturbation methods to examine the generalized Langevin equation (GLE) with state and memory dependent friction. The GLE describes the dynamics of a Brownian particle in an arbitrary potential field, acted on by a fluctuating force characterizing the collisions between the particle and the thermal bath. We consider the situation in which the collisions are not restricted to occur instantaneously and additionally these interactions are nonlinear. This leads to a non-Markovian description of the dynamics of the particle. We compute explicit analytical expressions for the mean exit time tau of the Brownian particle from the potential well in which it is confined. Thus we derive expressions for the activation rate κ from the well, which is inversely propor-

tional to tau. In the examples considered, the effect of the state dependent friction is to increase tau and thus to lower κ.

26651 Theory of multiwave propagation and frequency conversion in a Raman medium. Hickman, A.P.; Paisner, J.A.; Bischel, W.K. (Molecular Physics Department, SRI International, Menlo Park, California 94025). *Physical Review [Section] A: General Physics;* **33**: No. 3, 1788-1797(Mar 1986).

A theory is presented to describe the propagation of a laser pulse with several frequency components ω/sub j/ = ω/sub O/ +jω/sub R/ through a Raman medium, where ω_0 is the initial laser frequency and ω/sub R/ is the frequency of the Raman transition. We consider primarily the transient regime, where the pulse width is comparable to or less than the relaxation times of the medium. We formulate the Maxwell-Bloch equations in terms of a two-photon Rabi frequency Ω and an overall phase theta. The resulting equations are similar in form to those describing self-induced transparency, and exhibit solutions corresponding to slowly traveling, but ultimately decaying, pulses. Numerical solutions to the equations are presented that include pump depiction, the ac Stark shift, and finite relaxation times. Significant frequency conversion to high-order (j~8) anti-Stokes modes is observed in the numerical results.

6580 Mathematical Physics

REFER ALSO TO CITATION(S) 25623, 26468, 26623, 26634

26652 (IC—84/177) Homology and cohomology of a class of polycyclic groups. Majumdar, S. (International Centre for Theoretical Physics, Trieste (Italy)). Nov 1984. 6p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701462.

The homology and the cohomology of the class of polycyclic groups G given by generators h_1, h_2,..., hsub(n+1) and relations h_3^1 h_1 $h_3 = h_1$sup(m_1),h_3^1 h_2 $h_3 = h_2$sup(m_2),..., hsub(n+1)^1 hsub(n) hsub(n+1)=hsub(n)sup(msub(n)) are determined through the construction of a suitable free ZG resolution for the trivial ZG module Z.

26653 (IC—84/185) Embedding in inductive limits of linear topological spaces. Iyahen, S.O. (International Centre for Theoretical Physics, Trieste (Italy)). Nov 1984. 15p. (CONF-8410309—4). NTIS (US Sales Only), PC A02/MF A01. File Number DE86701463.

From Symposium on the state of physics and mathematics in Africa; Trieste, Italy (8 Oct 1984).

Let (E,u) be the inductive limit of a sequence (Esub(n),usub(n)) of linear topological spaces such that E is the union of linear subspaces Esub(n). The two related questions which receive attention here are as follows. When is a continuous linear map from a linear topological space F into (E,u) essentially a continuous linear map from F into some (Esub(n),usub(n)), and when is a bounded subset of (E,u) necessarily a bounded subset of some (Esub(n),usub(n)). The motivation is the result of A. Grothendieck, that both answers are in the affirmative if F and all of (Esub(n),usub(n)) are Frechet spaces. In this paper, more general conditions are given. For the situation in which the linear topological spaces are not locally convex, difficulties arise from inadequacy of convex bounded sets; to these, solutions are sought.

26654 (ORNL/TM—9864) Central limit theorem for variable size simple random sampling from a finite population. Wright, T. (Oak Ridge National Lab., TN (USA)). Feb 1986. Contract AC05-84OR21400. 27p. NTIS, PC A03/MF A01; GPO Dep. File Number DE86007092.

This paper introduces a sampling plan for finite populations herein called "variable size simple random sampling" and compares properties of estimators based on it with results from the usual fixed size simple random sampling without replacement. Necessary and sufficient conditions (in the spirit of Hajek) for the limiting distribution of the sample total (or sample mean) to be normal are given. 19 refs.

26655 (ORNL/TM—9983) Foundations of O-theory I: the intersection rule. Oblow, E.M. (Oak Ridge National Lab., TN (USA)). Mar 1986. Contract AC05-84OR21400. 32p. NTIS, PC A03/MF A01; GPO Dep. File Number DE86008565.

CESAR-86/10.

O-theory (OT) is a hybrid uncertainty theory which has been proposed for dealing with problems of uncertainty in logical inference. The foundations of one of the concepts of OT, the OT intersection operator, are explored in this paper. It is shown that a more fundamental basis for the OT rule is classical probability theory. Mass assignments in the Dempster-Shafer theory (DST) formalism are first reevaluated yielding a more basic relationship between masses and probabilities. These results are then used to show that the OT intersection rule can be derived from first principles in probability theory. A simpler axiomatic basis can then be used to establish this rule. It can, therefore, be used as alternative to Bayes' theorem for combining probabilistic belief consistently. Dempsters' rule will be shown to be a special case of the OT result. It too will be derived from probability theory axioms. 13 refs., 2 figs.

70 FUSION ENERGY

7001 Plasma Research

REFER ALSO TO CITATION(S) 26722, 26751, 26755

26656 (CONF-860316—2) Producing a steady-state population inversion. Richards, R.K.; Griffin, D.C. (Oak Ridge National Lab., TN (USA); Rollins Coll., Winter Park, FL (USA). Dept. of Physics). Mar 1986. Contract AC05-84OR21400. 4p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86008883.

From Topical meeting on short wavelength coherent radiation; Monterey, CA, USA (24 Mar 1986).

An observed steady-state transition at 17.5 nm is identified as the $2p^6 3s3p\ ^4S/sub\ 3/2/ \rightarrow 2p^6 3p\ ^2P/sub\ 3/2/$ transition in Na-like aluminum. The upper level is populated by electron inner shell ionization of metastable Mg-like aluminum. From the emission intensity, the rate coefficient for populating the upper level is calculated to be approximately 5×10^{-10}) cm^3/sec. Since the upper level is quasimetastable with a lifetime 22 times longer than the lower level, it may be possible to produce a population inversion, if a competing process to populate the lower level can be reduced.

26657 (CONF-860324—1) Highly doped ruby filters for stray light reduction in Scatpak II. Thomas, C.E. Jr.; Lazarus, E.A.; Kindsfather, R.R.; Painter, S.; Hays, P.; Murakami, M. (Oak Ridge National Lab., TN (USA)). 1986. Contract AC05-84OR21400. 17p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86007856.

From High temperature plasma diagnostics; Hilton Head Island, SC, USA (9 Mar 1986).

One of the major problems in Thomson scattering measurement of electron temperature is the suppression of stray light. Filters of AR-coated ruby with a high percentage doping of Cr have been produced for use on SCATPAK II. The filters have negligible attenuation of the signal above 7000 A° and attenuate light at the laser line by a factor of eta9. Experimental details of the filter performance, design, and fabrication are presented. The filter performance is compared with experimental measurements of the Cr-in-sapphire absorption cross-section at the R_1 line. Ruby filters present a cost-effective method of stray light suppression for experiments using ruby lasers and the red-shifted portion of the scattered spectrum. 6 refs., 3 figs.

26658 (CONF-860324—19) Measurements of Faraday rotation in TFTR plasmas. Ma, C.H.; Hutchinson, D.P.; Vander Sluis, K.L.; Mansfield, D.K.; Park, H.; Johnson, L.C. (Oak Ridge National Lab., TN (USA); Princeton Univ., NJ (USA)). 1986. Contract AC02-76CH03073;AC05-84OR21400. 12p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86008886.

From High temperature plasma diagnostics; Hilton Head Island, SC, USA (9 Mar 1986).

Recent results of simultaneous measurements of line electron density and poloidal field-induced Faraday rotation on the multichannel FIR interferometer/polarimeter on TFTR are presented. The procedures and results of the calibration are described in detail. The effects of various errors in the measurement, as well as the problem of cross-coupling laser beams, are studied.

26659 **(CTA-IEAV-RP—001/83) Possible explanation for the density threshold of the magnetohydrodynamic activity observed in Alcator C.** Galvao, R.M.O. (Centro Tecnico Aeroespacial, Sao Jose dos Campos (Brazil). Inst. de Estudos Avancados). 1983. 5p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701499.

The dependence on the density of the magnetic fluctuations measured in Alcator C is explained in terms of the influence of the diffusive flow on the saturation of magnetic islands.

26660 **(CTA-IEAV-RP—002/83) Resistive mode in rotating plasma columns including the hall current.** Galvao, R.M.O. (Centro Tecnico Aeroespacial, Sao Jose dos Campos (Brazil). Inst. de Estudos Avancados). 1983. 11p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701503.

A new resistive mode is shown to exist in rotating plasma columns. The mode is localized in the neighbourhood of the radius where the angular velocity of the bulk plasma is equal to minus half the local angular velocity of the ions. This singular point is caused by the Hall term in the generalized Ohm law. The growth rate of the mode scales with eta sup(1/2), where eta is the plasma resistivity.

26661 **(ENEA-RT-FUS—84-3) Scrape off plasma characteristics in the FT ohmic discharges.** Pericoli Ridolfini, V. (ENEA, Rome (Italy)). 1984. 17p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701501.

The temperature and the density of the plasma at the limiter shadow of FT (Frascati Tokamak) during ohmic operation and their radial variation have been measured. No dependence on the radius for the temperature has been found, while the density decays towards the wall in agreement with a simple model. The influence of the major plasma parameters on the scrape-off conditions has been studied. Some interesting features during discharges showing some peculiarity are described.

26662 **(ENEA-RT-FUS—84-13) Curvature effects in the nonlinear growth of the cylindrical tearing mode.** Somon, J.P. (ENEA, Rome (Italy)). 1984. 17p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701517.

The full set of the usual resistive massless equations is used to investigate the nonlinear growth of the helical perturbation to a cylindrical equilibrium with tokamak ordering. There is a curvature dependant critical magnetic island width xsub(T)sup(*) α set containing D/Δ' above which the Rutherford solution is recovered for the tearing mode as well as for the linear slow interchange modes with $\Delta' > 0$. Non linearity stabilizes at this critical width the linearly unstable slow interchange modes with $\Delta' > 0$.

26663 **(ENEA-RT-FUS—84-14) Larmor radius expansion for the inhomogeneous plasma dielectric tensor.** Ottaviani, M. (ENEA, Rome (Italy)). 1984. 14p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701500.

A larmour radius expansion for the dielectric tensor of an inhomogeneous plasma with perpendicular gradients is derived directly from the relativistic Vlasov equation. Various wave equations are derived from relevant radio frequency heating problems together with a generalized Poynting theorem. The validity of Kadomtev's assumption is discussed.

26664 **(ILE—8410P) X-ray and radioactive measurements in ICF research at ILE OSAKA.** Nishimura, H.; Niki, H.; Miyanaga, N. (Osaka Univ., Suita (Japan). Inst. of Laser Engineering). Sep 1984. 20p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701512.

The experimental basis and instrumentation for Gekko XII laser fusion program developed at the Institute of Laser Engineering(ILE), Osaka University are presented. Lots of diagnostics are in use to evaluate the key parameters of target implosion in an extremely dense, short period region. In this paper, we describe the present status and future planning of these diagnostics, such as x-ray, radioactive and reaction particle measurement because of their importance for fuel rhoR determination.

26665 **(INIS-mf—9862) IPP annual report 1984.** (Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.)). 1984. 223p. NTIS (US Sales Only), PC A10/MF A01. File Number DE86751111.

The scientific activities of IPP comprise two programmes, Tokamaks and Stellarators, the main results of which are summarized in two overviews introducing the corresponding sections in the body of the report. The scientific work is firmly integrated into a network of cooperation. In Germany, we collaborate with Kernforschungszentrum Karlsruhe in the 'Entwicklungsgemeinschaft Kernfusion'; of the collaboration with universities the most successful has been that with Stuttgart on ECRH. The IPP programme forms an integral part of the European fusion programme.

26666 **(IPP—6/250) Resistive Alfven spectrum of tokamak-like configurations.** Kerner, W.; Lerbinger, K.; Riedel, K. (Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.)). Aug 1985. 77p. NTIS (US Sales Only), PC A05/MF A01. File Number DE86751124.

The resistive Alfven spectrum for tokamak-like configurations with one or two singular surfaces is analyzed by combined WKBJ treatment and numerical solution using a spectral code. It is found that the ideal continua disappear; these are approximated only at the end points, at the singular surfaces and at selected interior points (given by extrema of the ideal Alfven dispersion relation). The normal modes are damped and the eigenvalues lie on specific curves which become independent of resistivity for small eta.

26667 **(IPP—6/252) Combined Maxwell and kinetic guiding-center theory with polarization drift: Regularized variational formulation with local charge and energy conservation.** Correa-Restrepo, D.; Pfirsch, D.; Wimmel, H.K. (Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.)). Aug 1985. 38p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86751117.

A formerly derived regularization method is applied to time-dependent Lagrangian guiding-center mechanics, with the polarization drift included. This approach removes the singularity that occurs for B-fields with non-vanishing parallel curl. From the Lagrangian equations of motion, Liouville's theorem and a collisionless kinetic equation for the 'regularized guiding centers' are derived. A common Lagrangian density for both the guiding centers and the Maxwell fields is obtained by using a 'constrained' Hamiltonian and a formerly derived, new variational principle. From this variational formalism local conservation laws for electric charge and energy are derived, together with the correct charge, current, energy and energy flux densities. These densities combine point-like contributions with electric polarization and magnetization terms.

26668 **(IPP—6/255) Finite-element semi-discretization of linearized compressible and resistive MHD.** Kerner, W.; Jakoby, A.; Lerbinger, K. (Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.)). Aug 1985. 69p. NTIS (US Sales Only), PC A04/MF A01. File Number DE86751123.

The full resistive MHD equations are linearized around an equilibrium with cylindrical symmetry and solved numerically as an initial-value problem. The semi-discretization using cubic and quadratic finite elements for the spatial discretization and a fully implicit time advance yields very accurate results even for small values of the resistivity. In the application different phenomena such as waves, resistive instabilities and overstable modes are addressed.

26669 (IPP—III/103) Investigations of MHD activity in ASDEX discharges. Stambaugh, R.; Gernhardt, J.; Klueber, O.; Wagner, F. (Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.)). Jun 1984. 35p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86751118.

This report makes a strong attempt to relate some specific observations of MHD activity in ASDEX discharges to observations made on the Doublet III and PDX tokamaks and to theoretical work on high β MHD modes at GA and PPPL. Three topics are discussed. The first topic is the detailed analysis of the time history of MHD activity in a β discharge. The β limit discharge in ASDEX is identified as a discharge in which, during constant neutral beam power, β reaches a maximum and then decreases, often to a lower steady level if the heating pulse is long enough. During the L phase of this discharge, the MHD activity observed in the B coils is both a continuous and bursting coupled m >= 1 mode of the 'fishbone' type. When β is rising in the H phase, this mode disappears; only ELMs are present. At βsub(max), a different mode appears, the m=2, n=1 tearing mode, which grows rapidly as β decreases. The second topic is the very new observation of the fishbone-like mode in a discharge heated by combined neutral beam and ion cyclotron heating power. The mode characteristics are modulated by sawtooth oscillations in a manner consistent with the importance of q(0) in the stability of this mode. The third topic is the search for ELM precursors in discharges designed to have no other competing and complicating MHD activity. In these cases nonaxisymmetric precursors to the Hsub(α) spike were observed. Hence, it appears that an MHD mode, rather than an energy balance problem, must be the origin of the ELM.

26670 (IPP—III/106) Hypotheses on L-H transition. Wong, S.K. (Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.)). Aug 1985. 13p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86751119.

Two hypotheses in connection with L-H transition are examined. The first is that the transition is triggered by the radial temperature gradient in a cold edge region exceeding a threshold. A number of observations relating to the occurrence of the H-phase can be understood qualitatively from this hypothesis. A possible theoretical basis in terms of stabilization of drift waves is found. The second hypothesis is that transport at the edge region in the H-phase is governed by neoclassical theory for electrons and ions. Exploration of the consequence on the temporal behavior of various signals indicates that while energy transport appears consistent with the predictions, particle transport appears much faster than neoclassical theory from the limited diagnostic information available.

26671 (IPPJ—670) Introduction to the theory of fluid and magnetofluid turbulence. Montgomery, D. (Nagoya Univ. (Japan). Inst. of Plasma Physics). Mar 1984. 144p. NTIS (US Sales Only), PC A07/MF A01. File Number DE86701515.

This set of notes was transcribed from the tape recording of three lectures given at the Institute of Plasma Physics, Nagoya University, in June, 1983. The lectures were intended to provide an introduction to the theory of magnetofluid turbulence which is a relatively new branch of plasma physics. It is related more closely to classic fluid dynamics than to the nonlinear theory of plasma oscillation. For this reason, fluid turbulence theory was reviewed as the background of the subject. The first lecture is on the origins of fluid and magnetofluid turbulence. The universal transition to turbulence takes place at sufficiently high Reynolds number, well above the critical threshold. The second lecture is on closures, attempt on dynamical theories. The Navier-Stokes case is discussed, and the attempt to reduce the number of the degrees of freedom, the importance of helicity in MHD, the direct interaction approximation (DIA) and others are explained. The third lecture is on the cascade and inverse cascade in fluid and magnetofluid. The idea of cascade was introduced into the theory of Navier-Stokes turbulence around 1941. The calculation of a form for inertial range energy spectra, the relation with dissipation rate, the tendency of migrating to long wavelength, the simulation of decaying turbulence, the numbers characterizing MHD and others are discussed.

26672 (IPPJ—696) Electromagnetic acceleration of macroparticles to hypervelocites in axisymmetric geometry. Ikuta, Kazunari. (Nagoya Univ. (Japan). Inst. of Plasma Physics). Oct 1984. 14p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701508.

An improved version of the plasma impulse accelerator for macroparticles is discussed in detail, overcoming the length limitation of the classical railgun.

26673 (IPPJ—698) Origin of plasma rotation in the early phase of an FRC produced by a reversed field theta pinch. Hirano, K.; Okamoto, M. (Nagoya Univ. (Japan). Inst. of Plasma Physics). Oct 1984. 14p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86701516.

A hybrid code simulating the early phase of a reversed field theta pinch shows the plasma is radially divided into oppositely rotating two parts during the plasma expansion phase after the shock collapse on the axis. Taking the direction of diamagnetic current as positive, we observe the inner part where vector potential Atheta is positive to rotate in a negative direction, and that the peripheral part having negative Atheta to rotate in a positive direction. These observations are in good agreement with the experimental measurements done in the STP-L apparatus. The radial splitting of the rotation can be understood by the conservations of the total mechanical angular momentum involved in the plasma, and canonical angular momentum along the trajectories of the plasma ions.

26674 (IPPJ-DT—113) Reversed field pinch experiments on HIT-1. Construction of Hiroshima Torus. Nagata, Akiyoshi; Shindo, Haruo; Tamaru, Takeshi. (Nagoya Univ. (Japan). Inst. of Plasma Physics). Mar 1984. 34p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. File Number DE86701506.

HIT-1 (Hiroshima Torus-1) is constructed to elucidate the basic physical phenomena in the reversed field pinch (RFP) plasma. Design of HIT-1 system started in April 1983 and construction of its major parts finished in December 1983. Computational analyses are performed to calculate the magnetic field distributions in the torus, the load current and voltage on the poloidal and toroidal circuits of HIT-1. The analytic methods and calculated results for the magnetic fields and the poloidal and toroidal circuits are described in detail.

26675 (JAERI-M—84-225) Numerical analyses of disruptive instabilities in a tokamak plasma. Tanaka, Yukio. (Japan Atomic Energy Research Inst., Tokyo). Dec 1984. 86p. (In Japanese). NTIS (US Sales Only), PC A05/MF A01. File Number DE86701518.

Linear stability and nonlinear evolution of the resistive mode, the resistive internal kink mode, and the tearing mode are studied numerically to analyze both internal and major disruptions in a tokamak plasma. A matrix method is devised for calculating linear stability of these modes. In the nonlinear phase the resistive mode grows exponentially with the linear growth rate until complete reconnection of the magnetic flux (the internal disruption) even for small resistivity of a realistic plasma. It is shown that in the sufficently unstable region of the ideal internal kink mode, the amplitude of the resistive internal kink mode is saturated without complete reconnection of magnetic flux. This result is consistent with suppression of the internal disruption observed in neutral beam injection heating experiments of a tokamak plasma. It is also shown that the toroidicity and elongation of the plasma cross-section scarcely affect the nonlinear interaction between different helicity tearing modes, which causes an abrupt destabilization to the major disruption.

26676 (JAERI-M—85-005) Development of 128 ch fast multi channel pulse height analyzer for a tokamak plasmas. Kawashima, Hisato; Matoba, Tohru; Ogawa, Toshihide; Kawakami, Tomohide. (Japan Atomic Energy Research Inst., Tokyo). Feb 1985. 20p. (In Japanese). NTIS (US Sales Only), PC A02/MF A01. File Number DE86701514.

A high counting rate multi channel pulse height analyzer was developed and tested to measure the detailed time evolution of X-ray energy spectrum radiated from a tokamak plasmas. Main de-

veloping objects of this analyzer are as follows. 1. The maximum counting rate and the minimum time resolution are 4 Mcps and 10 ms, respectively. 2. The energy resolution has ability to distinguish the characterisitic X-ray line. 3. Computer has to be used for operating system. This fast multi channel analyzer is using to measure the Soft X-ray spectrum on JFT-2M tokamak, and is confirmed to be useful for a practical measuring system.

26677 (Juel—1992) Theory of the rippling instability in toroidal devices. Rogister, A. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Plasmaphysik). Apr 1985. 38p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86751122.

The theory of the rippling instability is developed for axisymmetric toroidal plasmas including ion viscosity and parallel electron heat conduction, but assuming that the growth rate is small compared to the wave angular frequency. Parallel electron heat conduction is stabilizing but ion viscosity broadens the instability domain. Under certain conditions, an important top-bottom asymmetry of the density fluctuation spectrum may arise.

26678 (Juel—1997) Enhanced neoclassical pinch in the collisional regime of tokamaks. Rogister, A. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Plasmaphysik). Jun 1985. 25p. NTIS (US Sales Only), PC A02/MF A01. File Number DE86751121.

It is shown that the parallel electron viscosity leads to an enhanced pinching effect in the collisional regime. The experimental profiles in the plasma edge are inconsistent, from the point of view of power balance, with solely neoclassical heat losses by many orders of magnitude. Finally the poloidal rotation velocity obtains from ambipolarity.

26679 (LA—10653-MS) Density effects on sawtooth oscillations for high-θ 120 kA discharges in ZT-40M. Nebel, R.A.; Werley, K.A.; Pickrell, M.M. (Los Alamos National Lab., NM (USA)). Feb 1986. Contract W-7405-ENG-36. 22p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86008585.

The effects of using pulse discharge cleaning and neutral gas refueling to increase the plasma density for 120 kA high-θ discharges on ZT-40M have been studied. Experimentally, increasing the plasma density quenches the sawtooth oscillations. Theoretical analysis indicates that the likely reason for this observation is that increasing the plasma density lowers the on-axis streaming parameter which in turn flattens the effective resistivity profiles leading to smaller (or nonexistent) sawtooth excursions.

26680 (LA-UR—86-848) Multi-chord, near infrared interferometers for the CTX and ZT-40M experiments. Newman, E.W.; Buchenauer, C.J.; Hoida, H.W. (Los Alamos National Lab., NM (USA)). 1986. Contract W-7405-ENG-36. 13p. (CONF-860324—13). NTIS, PC A02/MF A01; GPO Dep. File Number DE86008729.

From High temperature plasma diagnostics; Hilton Head Island, SC, USA (9 Mar 1986).

A versatile multichord heterodyne CO_2 interferometer design is presented. The design is adaptable to several different experiments and has been implemented on CTX. The systems provide a wide dynamic range, real time density readout, high reliability and a minimal number of optical components.

26681 (ORNL/TM—9386) Investigation of the electric field structure in ISX-B plasmas. Mathew, J.; Hallock, G.A.; Jennings, W.C.; Hickok, R.L.; Wootton, A.J.; Sigmar, D.J. (Rensselaer Polytechnic Inst., Troy, NY (USA); Oak Ridge National Lab., TN (USA)). Apr 1986. Contract AC05-84OR21400. 94p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE86008947.

Plasma potentials have been measured for the first time in neutral-beam-heated tokamak discharges. Radial potential profiles have been obtained for coinjection, counterinjection, and balanced injection discharges as well as for ohmically heated plasmas in the Impurity Study Experiment (ISX-B) tokamak. Within experimental uncertainties, the measured values of potential are consistent with calculations based on radial momentum balance using experimental values of rotation velocities, density, and ion temperature. The measurements were made using a heavy-ion beam probe, with typical plasma conditions of I/sub p/ $\approx$ 150 kA, B/sub T/ $\approx$ 12.3 kG, n-bar/sub e/ $\approx 4 \times 10^{13}$ cm^{-3}, and P/sub b/ $\approx$ 0.9 MW. A negative potential well depth of about 1.0 kV was observed in ohmically heated plasmas and increased somewhat for balanced injection. Counterinjection resulted in a significantly larger well depth of approximately 3 to 4 kV, while coinjection showed an outward-pointing electric field in the plasma interior. The particle confinement times of both ions and impurities were observed to improve with counterinjection as compared with coinjection.

26682 (PFC/JA—86-10) Energy confinement of the high energy tail electrons during lower hybrid current drive on the Alcator C tokamak. Texter, S.; Bonoli, P.; Knowlton, S.; Porkolab, M.; Takase, Y. (Massachusetts Inst. of Tech., Cambridge (USA). Plasma Fusion Center). Mar 1986. Contract AC02-78ET51013. 13p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86009045.

The distribution function of the high energy electron tail generated during lower hybrid current drive at a density of anti n/sub e/ $= 3 \times 10^{13}$ cm^{-3} in the Alcator C tokamak has been determined. By performing a convolution integral with the collision operator, the power flow into the bulk plasma was calculated. With the assistance of code modeling, the energy confinement time of the fast electrons, and its dependence upon energy, was determined.

26683 (PPPL—2306) Tokamak fusion reactor start-up simulation. Ling, K.M.; Jardin, S.C.; Perkins, F.W. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Feb 1986. Contract AC02-76CH03073. 25p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86007536.

A simulation code TSEC (Time-dependent Spectral Equilibrium Code) has been developed to model the axisymmetric evolution of a tokamak on the resistive (L/R) time scale of the external coils, conductors, or shell. The electromagnetic interaction between the plasma and the external circuit is taken into account in a self-consistent manner. TSEC is Lagrangian and utilizes magnetic flux coordinates with spectral decomposition in the angle variable θ. The plasma is modeled as a finite-size, zero-inertia, finite-pressure fluid which adjusts its position and shape to remain in free-boundary equilibrium consistent with the currents in the external circuits. At the heart of TSEC is a fast method of calculating the self-consistent free-boundary plasma equilibrium at each time step which is based on the minimization of a certain mean-square error. 3 refs., 6 figs., 3 tabs.

26684 (SAIC—85/1922) Stabilization of magnetohydrodynamic modes by applied radiofrequency waves. D'Ippolito, D.A.; Myra, J.R. (Science Applications International Corp., Boulder, CO (USA). Plasma Research Inst.). Jan 1986. Contract AC03-76ET53057. 47p. (PRI—94). NTIS, PC A03/MF A01; GPO Dep. File Number DE86008564.

A kinetic theory describing the nonlinear interaction of radiofrequency waves with low frequency magnetohydrodynamic modes is presented. The calculation of the nonlinear force density on a fluid element includes both ponderomotive and sideband mode coupling terms and allows arbitrary rf wave polarization. Electromagnetic effects and wave-particle interactions are retained in the analysis. The influence of the nonlinear force on magnetohydrodynamic plasma stability is calculated self-consistently, and a generalized low mode number ballooning equation is obtained for paraxial magnetic mirror geometry. The low frequency stability problem is thereby shown to involve the coupling of four waves and the system of governing equations is presented. Specialized limits of the general equations are discussed, and a physical interpretation of rf stabilization is given. It is shown that stability is enhanced by placing the antenna and conducting cavity walls close to the plasma surface.

26685 (SAIC—86/1521) Induced azimuthal electric fields in a tandem mirror with throttle coils. Myra, J.R. (Science Applications International Corp., Boulder, CO (USA). Plasma Research Inst.). Jan 1986. Contract AC03-76ET53057. 8p. (PRI—96). NTIS, PC A02/MF A01; GPO Dep. File Number DE86008563.

A tandem mirror with an axisymmetric center cell separated from quadrupole regions by a large mirror ratio throttle coil is considered. Passing particles induce an azimuthal electric field in the center cell which destroys the axisymmetry of the guiding center orbits. It is shown that the resulting neoclassical resonant-plateau transport is small if dielectric resonances can be avoided.

26686 (UCRL—53717) X-ray imaging studies of electron cyclotron microwave-heated plasmas in the Tandem Mirror Experiment-Upgrade. Failor, B.H. (Lawrence Livermore National Lab., CA (USA)). Feb 1986. Contract W-7405-ENG-48. 185p. NTIS, PC A09/MF A01; 1; GPO Dep. File Number DE86008587.

An x-ray pinhole camera designed to efficiently detect photons with energies between 5 and 250 keV was built to image bremsstrahlung emission from a microwave-heated hot electron plasma. This plasma is formed at one of the thermal barrier locations in the Tandem Experiment-Upgrade at Lawrence Livermore National Laboratory. The instrument consists of a lead aperture, an x-ray converter in the form of a sodium-activated cesium iodide scintillator, light intensifier electronics, and a recording medium that may either be high speed film or a CCD array. The nominal spatial and temporal resolutions are one part in 40 and 17 msec, respectively. The component requirements for optimum performance were determined both analytically and by computer simulation, and were verified experimentally. The details of these results are presented. The instrument has been used to measure x-ray emission from the TMX-U west end cell. Data acquired with the x-ray camera has allowed us to infer the temporal evolution of the mirror-trapped electron radial profile.

26687 Observation of localized electron cyclotron resonance heating in a magnetic mirror. Rice, B.W.; Scharer, J.E. (Department of Electrical and Computer Engineering, University of Wisconsin, Madison, WI 53706). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Plasma Science;* **PS-14**: No. 1, vp(Feb 1986).

A right-hand circularly polarized (RHCP) electron cyclotron wave is launched along the axis of a steady-state magnetically confined plasma column. Detailed measurements of the spatial variation of electron temperature, density, plasma potential, and wave amplitude about the resonance zone are presented. In particular, data are presented where the temperature increase due to electron cyclotron resonance heating (ECRH) is strongly localized near the resonance position. A numerical wave heating model has been developed for electrons in a magnetic mirror and is found to be in qualitative agreement with observations.

26688 Tests of an ICRH resonant cavity launcher with Faraday shield. Baker, D.R.; Blau, F.P.; Hino, T.; Parks, P.B. (GA Technologies, San Diego, CA 92138). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Plasma Science;* **PS-14**: No. 1, vp(Feb 1986). Contract AC03-84ER53158.

A resonant cavity antenna designed to be suitable for ion cyclotron heating in a tokamak has been bench tested. This antenna is a "discrete element" circuit designed to launch the fast magnetosonics wave in a magnetized plasma. The resonant autotransformer design allows matching to the transmission-line impedance. The tuning and matching properties of this antenna have been compared with a simple computer model. The effective transmission of carious Faraday shields has been determined by measuring the change in Q of the antenna system with and without the shield. The test results show that the antenna behaves as predicted by a simple computer model and that coolable Faraday shields with high RF transmission can be designed.

26689 Beam probe space-potential measurement in a minimum-B field. Kolawole, J.O.; Pourrezaei, K.; Connors, K.A.; Woo, J.T. (Electrical, Computer, and Systems Engineering Department, Rensselaer Polytechnic Institute, Troy, NY 12180). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Plasma Science;* **PS-14**: No. 1, vp(Feb 1986). Contract AC02-76ET53004.

A measurement of plasma space potential in a minimum-B magnetic field has been made with a particle beam probe. The diagnostic technique is an extension of conventional heavy ion beam probing in that, among other features, the probing beam is neutral rather than ionized cesium and the parallel-plate electrostatic energy analyzer is fully characterized in a new manner which permits its use in complex magnetic confinement geometries.

26690 Hybrid two-dimensional electron transport in self-consistent electromagnetic fields. Mason, R.J.; Cranfill, C.W. (Los Alamos National Laboratory, Los Alamos, NM 87545). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Plasma Science;* **PS-14**: No. 1, vp(Feb 1986). Contract W-7405-ENG-36.

The paper outlines features of the implicit hybrid simulation code ANTHEM, which uniquely provides histories for the transport and deposition of suprathermal and thermal electrons in laser-produced plasmas. The code models two-dimensional electron transport through steep density gradients and across contiguous collisional and collisionless target regions with the plasma dynamics dominated by self-consistent E and B fields. ANTHEM employs separate Eulerian fluid ion and thermal electron treatments and models suprathermal electrons as either a third fluid or as a set of collisional particle-in-cell (PIC) particles. The authors outline new techniques required to obtain implicit electromagnetic fields in two spatial dimensions permitting time steps well in excess of the local plasma period. A new implicit scattering model is discussed. The utility of our approach is demonstrated with sample applications to collisional surface transport on foil targets.

26691 Electron hole oscillations below the plasma frequency in a planar gap. Swegle, J.A.; Darrow, D.S. (Plasma Theory Division, Sandia National Laboratories, Albuquerque, NM 87185). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Plasma Science;* **PS-14**: No. 1, vp(Feb 1986). Contract AC04-76DP00789.

The paper treats an initially cold, uniform, quasi-neutral plasma within a planar gap with walls that are perfectly absorbing but incapable of emission. In the idealized case where a voltage source is instantaneously applied to the gap, the authors find that at early times, while ions remain virtually motionless, some electrons are first expelled from the gap, after which the remaining electrons oscillate within the gap. The oscillation frequency lies below the electron plasma frequency and is shown to correspond to the plasma frequency of the expelled electrons if their density is averaged over the full gap.

26692 Nonlinear upper hybrid drift waves in the Vlasov-Maxwell approximation. Abraham-Shrauner, B. (Department of Electrical Engineering, Washington University, St. Louis, MO 63130). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Plasma Science;* **PS-14**: No. 1, vp(Feb 1986).

Upper hybrid drift waves are found as a special solution to a Vlasov-Maxwell plasma which has a longitudinal electric field and a perpendicular uniform magnetic field. A single-species plasma with a constant-density mobile neutralizing background supports spatially varying disturbances that oscillate at the upper hybrid frequency. The general functional dependences of the electric field, the plasma number density, and the one-particle distribution function for the special case are found from more general Vlasov-Maxwell equations invariant under a Lie group point transformation. The one-particle distribution function for the plasma is a function of the Liouville invariant, which is the energy in the generalized Bernstein-Greene-Kruskal (BGK) reference frame, and the momentum in the drift direction.

26693 On the reflection of ion-acoustic solitons from a bipolar potential structure. Raychaudhuri, S.; Trieu, B.; Tsikis, E.K.; Lonngren, K.E. (Department of Electrical and Computer Engineering, The University of Iowa, Iowa City, IA 52242). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Plasma Science;* **PS-14**: No. 1, vp(Feb 1986).

A potential structure consisting of a negatively biased screen placed in front of a positively biased plate and inserted in the target chamber of a double-plasma machine is shown to be a reflector of ion-acoustic solitons. A simple model is proposed to explain the reflection mechanism pioneered by Popa and Oertl. This structure is also an efficient launcher of ion-acoustic waves.

26694 Inductive sustainment of spheromaks. Janos, A.C.; Yamada, M. (Princeton Plasma Physics Lab., Princeton Univ., Princeton, NJ 08544). *Fusion Technology;* **9**: No. 1, vp(Jan 1986). Contract AC02-76CH03073.

Inductive formation and sustainment of spheromaks are examined. The S-1 device utilizes a flux core to form a spheromak inductively. Plasmas are observed to relax during formation toward a minimum energy state, independent of initial conditions. Inductive sustainment of spheromaks is considered possible by utilizing this relaxation process. One method uses a poloidal flux transformer along the major axis, similar to the ohmic heating transformer in a tokamak. Alternatively, spheromaks can be established with the outermost poloidal field lines linked around the flux core to provide coupling between the plasma and external circuits. The spheromak configuration then can be sustained by oscillating the currents in the poloidal and toroidal field coils within the flux core. These proposed current drive schemes are investigated using the concept of magnetic helicity injection.

26695 Hydrodynamic confinement of thermonuclear plasmas trisops VIII (plasma liner confinement). Wells, D.R.; Ziajka, P.E.; Tunstall, J.L. (Univ. of Miami, Dept. of Physics, Coral Gables, FL 33124). *Fusion Technology;* **9**: No. 1, vp(Jan 1986).

Experiments on fusion reactions produced by adiabatic compression of plasma vortex structures are discussed. The TRISOPS machine at the University of Miami has been modified by improving the preionization of the plasma and increasing the ring frequency of the conical theta-pinch coils. The results obtained with a series of experiments leading up to the latest machine, TRISOPS VIII, are reviewed. It has been possible, with this modified machine, to obtain ion temperatures of 1 keV before secondary magnetic compression without any magnetic guide field. Ion temperatures of over 6 keV are obtained with secondary magnetic compression fields of 30,000 G. The plasma pressure, in both instances, must be balanced by hydrodynamic forces. Ion temperatures and densities were measured by three different methods. All methods yield essentially the same results. The plasma was held in stable equilibrium for 30 μs and neutrons were produces for 40 μs.

26696 Semi-implicit method for three-dimensional resistive magnetohydrodynamic simulation of fusion plasmas. Harned, D.S.; Kerner, W. (New York University, Courant Institute of Mathematical Sciences, New York, New York 10012). *Nuclear Science and Engineering;* **92**: No. 1, vp(Jan 1986).

A semi-implicit method for solving the full compressible resistive magnetohydrodynamic equations in three dimensions is presented. The method is designed for use in the modeling of fusion plasmas in magnetic confinement devices. The method is unconditionally stable with respect to the fast compressional modes. The time step is limited instead by the slower shear Alfven motion. The computing time required for one time step is essentially the same as that for explicit methods. The code is applied to resistive instabilities in cylindrical tokamak equilibria.

26697 Finite element solution of the Fokker-Planck equation in electrostatic magnetic mirror fusion machines. Zerguini, T.H. (University of Illinois, Nuclear Engineering Program, Fusion Studies Laboratory, Urbana, IL 61801). *Nuclear Science and Engineering;* **92**: No. 1, vp(Jan 1986).

A perturbation method is developed to find solutions of sloshing ion distributions. This method uses an expansion in the ratio of electrostatic potential to average ion energy to simplify the bounce-averaged Fokker-Planck equation. Finite element techniques, which provide rapid numerical solutions for parametric studies of sloshing ions, are used to derive the zeroth-order angular and velocity equations. The first-order two-dimensional equation was also expanded into finite element "hat functions". Application of Galerkin's method gives a linear system of equations where all matrix and source elements are calculated analytically. The density ratio and the potential profiles as functions of axial distance are computed. There is excellent agreement with results from the Lawrence Livermore National Laboratory bounce-averaged Fokker-Planck code with as much as 500 times and 50 times less Cray-1 computer time for the zeroth- and the first-order solutions, respectively.

26698 Mirnov oscillations as a diagnostic for the radial electric field in tokamaks. Hassam, A.B.; Scott, B.D.; Drake, J.F.; Boyd, D.A. (Maryland Univ., College Park, USA. Lab. for Plasma and Fusion Energy Studies). *Comments on Plasma Physics and Controlled Fusion;* **9**: No. 5, 207-213(Dec 1985).

Mirnov oscillations cannot result from diamagnetic propagation as pressure profiles are flattened across magnetic islands, by thermal conduction and sound waves at very small island widths. The oscillations, therefore, are a measure of the radial electric fields.

26699 Possibility of parametric instabilities in electron cyclotron heated plasmas in Doublet III. Tripathi, V.K. (GA Technologies, Inc., San Diego, CA, USA). *Nuclear Fusion;* **25**: No. 12, 1788-1790(Dec 1985).

An evaluation is made of the convective thresholds for the onset of parametric instabilities in the electron cyclotron heated Doublet III plasmas when the operating radiofrequency is 60 GHz. For heating at the fundamental frequency, the convection losses are quite strong so that threshold powers much in excess of present-day power inputs are required. At the second harmonic, the process of resonant decay into two short-wavelength electron Bernstein waves offers the minimum threshold power, which is, however, still somewhat higher than the 650 kW being currently applied.

26700 Compton and Raman free electron laser stability properties for a cold electron beam propagating through a helical magnetic wiggler. Davies, J.A.; Davidson, R.C.; Johnston, G.L. (Clark Univ., Worcester, MA, USA; Science Applications, Inc., Boulder, CO, USA; Massachusetts Inst. of Tech., Cambridge, USA. Plasma Fusion Center). *Journal of Plasma Physics;* **33**: 387-423(Jun 1985).

An extensive characterization is given of the range of validity of the Compton and Raman approximations to the exact free electron laser dispersion relation for a cold, relativistic electron beam propagating through a constant-amplitude helical wiggler magnetic field. The electron beam is treated as infinite in transverse extent. Specific properties of the exact and approximate dispersion relations are investigated analytically and numerically. In particular, a detailed numerical analysis is carried out to determine the range of validity of the Compton approximation.

26701 Resonance cone structure in a warm inhomogeneous bounded plasma with lower-hybrid resonance layers. Grabbe, C.L. (Iowa Univ., Iowa City, USA. Dept. of Physics and Astronomy). *Journal of Plasma Physics;* **33**: 321-357(Jun 1985).

The problem of the wave fields excited by a gap source at the edge of an inhomogeneous, magnetized plasma with a pair of lower-hybrid resonance layers present and bounded by conducting walls is solved. The approach used is that of a solution as a sum of multiply-reflected extraordinary mode and ion-thermal resonance cones as an alternative to the guided-wave mode approach. Evanescent resonance cones are found to exist in the high-density region between the hybrid resonance layers and tunnel through to the other side, maintaining their general structure if the layer is relatively thin.

26702 RF current drive with magnetic helicity injection. Bhadra, D.K.; Chu, C. (GA Technologies, Inc., San Diego, CA, USA). *Journal of Plasma Physics;* 33: 257-264(Apr 1985).

External injection of magnetic helicity into a plasma may be possible through the introduction of appropriately polarized electromagnetic waves. A concept of steady-state current-drive is presented, based on the validity of conservation of helicity. It is shown that such external injection of helicity can maintain a steady-state current by compensating the volt-seconds consumed through plasma resistivity. Such a mechanism, if experimentally successful, is particularly interesting at high densities because the efficiency of the process does not depend on plasma density, as opposed to other radio-frequency current-drive techniques.

26703 Some properties of the Fokker-Planck equation. Lewak, G.J.; Soto, L.A. (California Univ., San Diego, La Jolla, USA. Dept. of Electrical Engineering and Computer Sciences). *Journal of Plasma Physics;* 33: 183-189(Apr 1985).

The solution of the Fokker-Planck equation for the distribution function of heavy ions in a background of electrons is studied. It is found that quite broad physical conditions on the distribution function are sufficient to eliminate any ambiquity in the time-independent steady-state solutions and to determine a discrete spectrum of the time-dependent Fokker-Planck operator. The more physical case of a Maxwell-Boltzman electron distribution function is treated using the small mass ratio expansion. First-order mass ratio corrections are calculated. A plasma heating application is suggested.

26704 Advanced concepts in the United States fusion program. Dove, W.F. (Advanced Fusion Concepts Branch, Office of Fusion Energy, Office of Energy Research, U.S. DOE, Washington, DC). pp 3-5 of Proceedings of the 20th intersociety energy conversion engineering conference. Volume 3. Warrendale, PA; Society of Automotive Engineers, Inc. (1985). (CONF-850808—).

From 20. intersociety energy conversion engineering conference; Miami Beach, FL, USA (18 Aug 1985).

The goal of the magnetic fusion program is to establish the scientific and technological base for fusion energy. Development of a variety of magnetic confinement systems is essential to achieving that goal. The role of the advanced concepts program is to conduct experimental investigations of confinement concepts other than the tokamaks and tandem mirror concepts. The present advanced concepts program consists of the reversed-field-pinch (RFP), the spheromak and the field-reversed configuration (FRC). Significant new experiments in the RFP and FRC concepts have been approved and are described.

26705 Recent results on ICRF heating on PLT. Wilson, J.R.; Denne, B.; Hinnov, E.; Hosea, J.C.; Hwang, D.; Manos, D.; Mazzucato, E.; Semet, A.; Stratton, B.; Suckewer, S. (University, Princeton, NJ). pp 69 of 1983 IEEE interaction conference on plasma science. New York, NY; IEEE (1983). (CONF-830590—).

From IEEE international conference on plasma science; San Diego, CA, USA (25 May 1983).

Abstracts Only.

Previous work in ICRF heating on PLT has concentrated on demonstration of heating efficiencies and mechanisms, and on establishment of a good data base to extrapolate ICRF heating to future large devices. Recent experiments have concentrated on gaining a more thorough knowledge of the physics through changes in wave launching structures.

26706 Tokamak wave coupling and heating in the ICRF. Romero, H.; Scharer, J.; Sund, R. (University of Wisconsin, Madison, WI). pp 68 of 1983 IEEE interaction conference on plasma science. New York, NY; IEEE (1983). (CONF-830590—).

From IEEE international conference on plasma science; San Diego, CA, USA (25 May 1983).

Abstracts Only.

The authors consider wave propagation in the vicinity of the Ion Cyclotron Range of Frequencies (ICRF) in general tokamak geometries. The problem of wave coupling by means of waveguides is addressed. In particular, the reflection coefficient for a simple TE_{10} waveguide is obtained by taking into account both the z and y spectrum of the launcher. In order to take into account spatial gradients in the plasma medium, they use a one-dimensional slab model of the plasma. Good coupling and heating results are obtained for the first few harmonics for sufficiently weak edge density gradient and > about 1 keV core temperatures. To analyze the heating of the plasma interior in the presence of ICRF, a 2-D differential equation is being developed which takes into account spatial gradients and mode coupling.

26707 RF Experiments on the PLT Tokamak. Wilson, J.R. (Princeton University). pp 3 of 1983 IEEE interaction conference on plasma science. New York, NY; IEEE (1983). (CONF-830590—).

From IEEE international conference on plasma science; San Diego, CA, USA (25 May 1983).

Abstracts Only.

In previous RF experiments on the PLT tokamak, both efficient ion heating with fast magnetosonic waves and current drive with lower hybrid waves have been demonstrated. Recent experiments are concentrating on gaining a more thorough understanding of the physics through changes in the wave launching structures. A pair of quarter-turn, center-fed outside ICRF antennae has been installed in order to make comparisons with the present end-fed, half-turn loops. Three of the half-turn outside antennae have been modified to have carbon Faraday shields. The lower hybrid wave launcher has been changed to an eight waveguide grill with individual guides of half the width of the previous grill. This change permits the launching of a slower wave spectrum. The new coupler also has tuned dummy waveguide sections on each end in an attempt to reduce reflections in the outer most driven guides.

26708 Lower hybrid current drive and heating experiments at high plasma densities on alcator C. Schuss, J.J.; Bonoli, P.; Englade, R.; Fiore, C.; Gandy, R.; Granetz, R.; Lloyd, B.; Porkolab, M.; Takase, Y.; Texter, S. (Plasma Fusion Center, MIT, Cambridge, MA). pp 3-4 of 1983 IEEE interaction conference on plasma science. New York, NY; IEEE (1983). (CONF-830590—).

From IEEE international conference on plasma science; San Diego, CA, USA (25 May 1983).

Abstracts Only.

The authors report the results of lower hybrid current drive and heating experiments on the Alcator C tokamak at plasma densities in the 10^{14} cm^{-3} range using two 16 waveguide arrays. Net RF powers up to 1 MW have been injected into the Alcator C plasma at 4.6 GHz using both arrays, or up to 650 kW of net RF power using one; the maximum RF power density achieved at the mouth of the waveguide array without arcing was 9 kW/cm^2. Current drive experiments are usually carried out by phasing a waveguide array 0, $\pi/2$, π, $3\pi/2$, which then launches a lower hybrid wave power spectrum concentrated in the range $1 < k\ c/\omega < 2.5$. Plasma currents of 150 200 kA have been driven by the RF for times greater than 100 msec at n/sub e/ up to 5×10^{13} cm^{-3} using one array alone. At n/sub e/ $\approx 3.5 \times 10^{13}$ cm^{-3} at B/sub T/ = 8 T in hydrogen discharges, constant plasma currents of 125 kA have been maintained by the RF power for more than 300 msec with zero loop voltage and constant internal inductance. During these shots after plasma initiation the current in the ohmic heating transformer is zero, so that in the absence of RF these plasmas decay with a 150 msec time constant. The best current drive efficiencies obtained were at B/sub T/ = 10 T and are n/sub e/ (10^{14} cm^{-3}) I/sub P/ (A)/P(W) = .19. At n/sub e/ $\leqq 5 \times 10^{13}$ cm^{-3} there is no evidence of any difference in current drive efficiency between hydrogen or deuterium plasmas for a given magnetic field in the range B/sub T/ = 8-10 T.

26709 Effects of increasing ω/sub pe/ /ω/sub ce/ on Cerenkov and anomalous doppler resonances and lower hybrid current drive. Chu, T.K.; Bernabel, S.; Hooke, W.; Jobes, F.; Stevens, J.; Von Goeler, S. (Princeton University). pp 3 of 1983 IEEE interaction conference on plasma science. New York, NY; IEEE (1983). (CONF-830590—).

From IEEE international conference on plasma science; San Diego, CA, USA (25 May 1983).

Abstracts Only.

Experiments of current drive in tokamaks by lower hybrid waves have shown that for a given wave frequency and magnetic field, current drive efficiency (n/sub e/ I/sub p/ /P/sub RF/) decreases rapidly as density is increased towards a limiting value, and a higher-frequency RF wave drives current in higher density regimes if the magnetic field is also increased. These results have been interpreted as due to decreasing wave accessibility and to excitation of parametric instabilities. Another possible mechanism which may contribute to the observed density limit is the reduced production of tail electrons by Cerenkov and Doppler resonances when ω/sub pe/ /ω/sub ce/ is increased; these resonances have been proposed as the mechanism producing the tail. Based on this model, we evaluated the current that can be carried by the tail electrons as a function of ω/sub pe/ /ω/sub ce/ for different assumed k_{11}/k values of Cerenkov and anomalous Doppler resonances, and for different spectra of launched lower hybrid waves. Results show similar dependence on ω/sub pe/ /ω/sub ce/ as that in the experimentally observed current drive efficiency.

26710 Ion cyclotron heating and its effect on particle orbits in ATF. Hoffman, D.J.; Eldridge, O.C.; England, A.C.; Fowler, R.H.; Harris, J.H.; Jernigan, T.C.; Lyon, J.F. (Oak Ridge National Laboratory, Oak Ridge, TN). pp 67 of 1983 IEEE interaction conference on plasma science. New York, NY; IEEE (1983). (CONF-830590—).

From IEEE international conference on plasma science; San Diego, CA, USA (25 May 1983).

Abstracts Only.

Ion cyclotron heating is proposed as a means to both heat and generate plasma. Calculations show that a 2 MW, 13-29 MHz RF system can couple power to the slow or fast waves through a flexible antenna. Typically, loading is expected to be 1-4 ohms for 2 x 10^{13} cm^{-3} ≦n ≦ 1 x 10^{14} cm^{-3}. This should result in a temperature increase of ΔT about 1400 eV for n about 5 x 10^{13} and tau/sub E/ about 30msec. The wave is expected to heat in perpendicular velocity space without serious deleterious effects on single particle orbits. This is because potentials in the plasma move the loss cone away from perpendicular velocity space for particle energies as great as 20 keV. Monte-Carlo models of particles gaining energy in the resonant zone show that a tail can build up, but no damping mechanism has been put into the code.

26711 Emission near the electron plasma frequency in low density OH and LHCD discharges. Efthimion, P.; Arunasalam, V.; Bernabei, S.; Boyd, D.; Cavallo, A.; Hosea, J.; Hovey, J.; Hwang, D.; Jobes, F.; Meservey, E. (Princeton Univ., Princeton, NJ). pp 2 of 1983 IEEE interaction conference on plasma science. New York, NY; IEEE (1983). (CONF-830590—).

From IEEE international conference on plasma science; San Diego, CA, USA (25 May 1983).

Abstracts Only.

In low density PLT discharges (n/sub e/ < about 1.0 x 10^{13} cm^{-3}) emission near, and far below, the central electron plasma frequency has been observed. The motivation for these measurements originates from theories that explain the evolution of "slideaway" electron tails in low density ohmicallyheated and lower-hybrid-current-driven discharges (Parail and Pogutse[1], Liu et al[2], and Taylor et al[3]) with the assistance of electrostatic plasma waves. These waves are excited through the interplay of the anomalous Doppler resonance and the Cerenkov resonance. Measurements were made with an absolute calibrated scanning (2-18 GHz) heterodyne receiver connected to a broadband spiral antenna. The measured emission near and below the plasma frequency is nonthermal with radiation temperature, Tr about 20-500 keV. The shape of the spectrum is not sensitive to the plasma density, but is strongly dependent on the toroidal magnetic field.

26712 Experimental observation of fast-magnetosonic waves between the fundamental and second harmonic ion cyclotron frequencies in the PLT Tokamak. Thompson, H.R.; Hosea, J.C.; Wilson, J.R. (Princeton University, Princeton, NJ). pp 69 of 1983 IEEE interaction conference on plasma science. New York, NY; IEEE (1983). (CONF-830590—).

From IEEE international conference on plasma science; San Diego, CA, USA (25 May 1983).

Abstracts Only.

The propagation of fast-magnetosonic waves in a single-species plasma, from the fundamental of the ion-cyclotron frequency to the second harmonic frequency, has been investigated in recent experiments on the PLT tokamak, at a fixed frequency of 42 MHz, and at low powers (P /sub f/ < 10 kW). To highlight the effect of cyclotron damping near the second harmonic, a pure hydrogen plasma was used, avoiding the effect of degeneracy between the second harmonic and the fundamental of impurity ion species.

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REFER ALSO TO CITATION(S) 25616, 25847, 25859, 25882, 25979, 25980, 25982, 26587, 26603, 26604, 26604, 26607, 26665, 26674, 26704

26713 (CONF-850814—38) Test results of the vapor-cooled leads for the IFSMTF. Lue, J.W.; Fietz, W.A.; Stamps, R.E.; Zahn, G.R. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 10p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86008977.

From Cryogenic engineering conference and international cryogenic materials conference; Boston, MA, USA (12 Aug 1985).

A vapor-cooled lead system that used six pairs of leads in twelve separate dewars was built for the International Fusion Superconducting Magnet Test Facility (IFSMTF). Each of these leads was cooled by helium vapor from a reservoir separate from the coil, in pool boiling or by force flow. Satisfactory acceptance tests were performed on the early production runs of the leads. Inconsistent and anomalously high heat losses were observed on the two pairs of lead assemblies used in the partial-array test. Additional tests on the leads and their associated dewars confirmed satisfactory performance of the lead and dewar and offered an explanation for the excessive losses during the partial-array test.

26714 (CONF-851102—107) Plasma engineering assessments of compact ignition experiments. Houlberg, W.A. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86008979.

From 11. symposium on engineering problems in fusion research; Austin, TX, USA (18 Nov 1985).

Confinement, startup sequences, and fast-alpha particle effects are assessed for a class of compact tokamak ignition experiments having high toroidal magnetic fields (8 to 12 T) and high toroidal currents (7 to 10 MA). The uncertainties in confinement scaling are spanned through examples of performance with an optimistic model based on ohmically heated plasmas and a pessimistic model that includes confinement degradation by both auxiliary and alpha heating. The roles of neoclassical resistivity enhancement and sawtooth behavior are also evaluated. Copper toroidal field coils place restrictions on pulse lengths due to resistive heating, so a simultaneous rampup of the toroidal field and plasma current is proposed as a means of compressing the startup phase and lengthening the burn phase. If the ignition window is small, fast-alpha particle physics is restricted to the high-density regime where a short slowing-down time leads to low fast-particle density and pressure contributions. Under more optimistic confinement, a larger ignition margin broadens the range of alpha particle physics that can be addressed. These issues are illustrated through examples of transport simulations for a set of machine parameters called BRAND-X, which typify the designs under study.

26715 (CONF-860324—14) Software architecture for the ORNL large coil test facility data system. Blair, E.T.; Baylor, L.R. (Oak Ridge National Lab., TN (USA)). 1986. Contract AC05-84OR21400. 16p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86008506.

From High temperature plasma diagnostics; Hilton Head Island, SC, USA (9 Mar 1986).

The VAX-based data acquisition system for the International Fusion Superconducting Magnet Test Facility (IFSMTF) at Oak Ridge National Laboratory (ORNL) is a second-generation system that evolved from a PDP-11/60-based system used during the initial phase of facility testing. The VAX-based software represents a layered implementation that provides integrated access to all of the

data sources within the system, deoupling end-user data retrieval from various front-end data sources through a combination of software architecture and instrumentation data bases. Independent VAX processes manage the various front-end data sources, each being responsible for controlling, monitoring, acquiring and disposing data and control parameters for access from the data retrieval software. This paper describes the software architecture and the functionality incorporated into the various layers of the data system.

26716 **(CONF-860324—15) Design and implementation of a control system for a deuterium pellet injector.** Burris, R.D.; Baylor, L.R.; Greenwood, D.E.; Stewart, K.A. (Oak Ridge National Lab., TN (USA)). Mar 1986. Contract AC05-84OR21400. 17p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86008503.

From High temperature plasma diagnostics; Hilton Head Island, SC, USA (9 Mar 1986).

The Oak Ridge National Laboratory is currently developing a Deuterium Pellet Injector for installation on the Tokamak Fusion Test Reactor (TFTR). This paper describes the design and development of a stand-alone data acquisition and control system for that device. Major elements of the hardware are an Allen-Bradley PLC 2/30 programmable logic controller, a MicroVAX-II computer using the VMS operating system, CAMAC data acquisition and communication equipment, and special-purpose controllers for temperature and for the sequencing of pellet firing valves. The PLC performs all actual control actions and acquires data pertinent to those actions. The MicroVAX receives the data acquired by the PLC, displays it for the operator, prompts for and processes requests for action from the operator, and informs the PLC of those requests. The primary purpose of this paper is to describe the software operating in the MicroVAX, including the system architecture, major tasks, and ancillary and background tasks.

26717 **(CONF-860421—4) Program of United States-Japan collaborative testing in HFIR and ORR.** Scott, J.L.; Grossbeck, M.L.; Hishinuma, A.; Kondo, T.; Rowcliffe, A.F.; Tanaka, M.P. (Oak Ridge National Lab., TN (USA); Japan Atomic Energy Research Inst., Tokai, Ibaraki). 1986. Contract AC05-84OR21400. 14p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86008531.

From 2. international conference on fusion reactor materials (ICFRM-2); Chicago, IL, USA (13 Apr 1986).

The objective of the program of US-Japan collaborative testing in HFIR and ORR is to investigate the response of austenitic stainless steels to levels of neutron radiation damage anticipated in fusion reactors. Emphasis is placed on United States and Japanese type 316 stainless steels and prime candidate alloys (PCA), but improved alloys are also included. The program consists of eight HFIR target capsules and two ORR spectral tailoring capsules with test temperatures of 60 to 600°C and fluences of 30 to 50 dpa. Helium contents after irradiation match or exceed those produced in a fusion reactor. Types of data to be obtained include tensile, fatigue, crack growth, irradiation creep, swelling, and microstructural evolution. Five HFIR capsules have been irradiated, and testing is under way. Less than 1% swelling is observed for type 316 stainless steels and PCA alloys irradiated to about 30 dpa at 300 to 500°C.

26718 **(DOE/ER/13302—T1) Production of ultrahigh magnetic fields. Technical progress report.** (JAYCOR, San Diego, CA (USA)). 25 Oct 1985. Contract FG03-84ER13302. 75p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE86006838.

A general method for producing controlled ultrahigh magnetic fields up to the order to 100 MG has been proposed recently. The general method involves imploding a plasma in which a magnetic field has been entrained. The imploding plasma compresses the magnetic field to high strengths. This paper reports the experimental test at the 1 to 2 MG level and high repetition rate of an embodiment of this method using a gas-puff Z pinch.

26719 **(IA—1396) PLASMOR: a laser-plasma simulation code.** Krumbein, A.D.; Salzmann, D.; Szichman, H.; Eliezer, S. (Israel Atomic Energy Commission, Yavne. Soreq Nuclear Research Center). Apr 1985. 47p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86901081.

The laser-plasma simulation code, PLASMOR, a one-dimensional Lagrangian hydrodynamics program, is described in detail. Special emphasis is placed on its special features which include non-LTE atomic physics, an advanced two-temperature equation-of-state model, ability to calculate layered targets and incorporation of the effects of suprathermal electron and radiation preheat. 34 refs.

26720 **(IPP—6/253) Hamiltonian approach to magnetic fields with toroidal surfaces.** Salat, A. (Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.)). Jul 1985. 33p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86751120.

The equivalence of magnetic field line equations to a one-dimensional time-dependent Hamiltonian system is used to construct magnetic fields with arbitrary toroidal magnetic surfaces I = const. For this purpose Hamiltonians H which together with their invariants satisfy periodicity constraints have to be known. The choice of H fixes the rotational transform eta(I). Arbitrary axisymmetric fields, and nonaxisymmetric fields with constant eta(I) are considered in detail. Configurations with coinciding magnetic and current density surfaces are obtained. The particular approach used is not well suited, however, to satisfying the additional MHD equilibrium condition of constant pressure on magnetic surfaces.

26721 **(IPPJ-DT—112) Historical records of the electric power and cooling water systems for the experimental facilities in the I.P.P. (1964-1983).** Kitajima, Miyoshi. (Nagoya Univ. (Japan). Inst. of Plasma Physics). Jan 1984. 39p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. File Number DE86701519.

Twenty years have passed, since experimental studies began in the IPP. This is a status report on the electric power and cooling water systems in this Institute. Historical records on consumption of the electric power and cooling water for experimental facilities are summarized, also. Valuable stories obtained through operation, control and periodic inspection of these systems are described, which will be helpful for construction of new systems in future. Finally problems on safety, reliability, and economy are commented.

26722 **(JAERI-M—85-006) Annual report of the Fusion Research Center for the period of April 1, 1983 to March 31, 1984.** (Japan Atomic Energy Research Inst., Tokyo). Mar 1985. 238p. NTIS (US Sales Only), PC A11/MF A01. File Number DE86701502.

Research and development activities of the Fusion Research Center (Department of Thermonuclear Fusion Research and Department of Large Tokamak Development) from April 1983 to March 1984 are described. Installation and commissioning of the new tokamak JFT-2M had been completed. The 2nd ICRF heating experiment and LH current drive experiment were started. In the field of plasma theory, the scaling law of the critical beta in a tokamak was obtained and the ICRF heating was analyzed in detail. The first phase of the cooperation of Doublet III will be finished in September 1984. The JT-60 program progressed as scheduled. Installation of the tokamak machine, initiated in February 1983, will be finished in September 1984. The tests of power supply and control system on site and the fabrication of the neutral beam injectors in factory proceeded successfully. Performance tests of prototype injector unit for JT-60 NBI progressed as scheduled. A new advanced source plasma generator was developed to provide a high proton ratio exceeding 90%. Klystrons for JT-60 LH heating achieved the output power of 1 MW for 10 sec. Performance tests of titanium evaporators for JT-60 were completed. The Japanese coil for IEA Large Coil Task was installed in a test facility at ORNL and the partial cool-down was carried out. Construction of the Tritium Process Laboratory was completed. Design studies of the Fusion Experimental Reactor (FER) and INTOR proceeded.

26723 **(JAERI-M—85-007) Measurements of emissivities on JT-60 first wall materials (inconel 625, Mo, TiC-coated Mo).** Nakamura, Hiroo; Shimizu, Masatsugu; Makino, Toshiro; Kunitomo, Takeshi. (Japan Atomic Energy Research Inst., Tokyo). Feb 1985. 34p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. File Number DE86701521.

To evaluate heat removal performance of JT-60 first wall, emissivities and reflectivities on Inconel 625, Mo, TiC coated Mo with optically smooth surface and actual surface are measured at temperature from a room temperature to 1300 K. Spectra are measured in the range of wave lengths from 0.34 μm to 20 μm. Actual surfaces are machined/pickled surfaces for Inconel 625, electro-polished surfaces for molybdenum, and as-coated surfaces for TiC-coated molybdenum. Results of Inconel 625 and molybdenum with optically smooth surfaces are examined by a two-electrons-type dispersion model of optical constants. Electronic constants of the equation are given and formulated in order to correlate the macroscopic properties of the radiative heat transfer. Total emissivities, obtained from the spectral emissivities of optically smooth surface, are 0.13(RT) -- 0.21(1300 K) for Inconel 625, 0.035(RT) -- 0.18(1300 K) for Mo, and 0.053(RT) for TiC-coated Mo. Moreover, total emissivities of the actual surface at a room temperature are 0.35(Inconel 625), 0.124(Mo), and 0.073(TiC-coated Mo). Large dependence of the emissivities on temperature and wave length shows that the model including these dependences is necessary for an accurate evaluation of the radiative heat transfer.

26724 **(JAERI-M—85-009) Benchmark test of MORSE-DD code using double-differential form cross sections.** Nakagawa, Masayuki; Mori, Takamasa; Ishiguro, Yukio. (Japan Atomic Energy Research Inst., Tokyo). Feb 1985. 63p. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. File Number DE86701522.

The multi-group double-differential form cross sections (DDX) and the three dimensional Monte Carlo code MORSE-DD devised to utilize the DDX, which were developed for the fusion neutronics analysis, have been validated through many benchmark tests. All the problems tested have a 14 MeV neutron source. To compare the calculated results with the measured values, the following experiments were adopted as the benchmark problems: leakage neutron spectra from spheres composed of nine kinds of materials measured at LLNL, neutron angular spectra from the Li_2O slab measured at FNS in JAERI, tritium production rate (TPR) in the graphite-reflected Li_2O sphere measured at FNS and the TPR in the metallic Li sphere measured at KfK. In addition, in order to test an accuracy of the calculation method in detail, spectra of neutrons scattered from a small sample and various reaction rates in a Li_2O cylinder were compared between the present method and the continuous energy Monte Carlo method. The nuclear data files used are mainly ENDF/B4 and partly JENDL-3PR1. The tests were carried out through a comparison with the measured values and also with the results obtained from the conventional Legendre expansion method and the continuous energy Monte Carlo method. It is found that the results by the present method are more accurate than those by the conventional one and agree well with those by the continuous energy Monte Carlo calculations. Discrepancies due to the nuclear data are also discussed.

26725 **(JAERI-M—85-022) R and D results of carbon and titanium carbide coating on molybdenum substrate for JT-60 first wall.** Nakamura, Hiroo; Ogiwara, Norio; Inagawa, Konosuke; Takahashi, Yoshikazu; Itoh, Akio. (Japan Atomic Energy Research Inst., Tokyo). Mar 1985. 56p. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. File Number DE86701523.

This report describes R and D results of carbon and titanium carbide coating on molybdenum for JT-60 first wall done in FY 1980. The reactive glow discharge method for carbon coating and the hollow-cathode-type physical vapor deposition (HCD-PVD) method for titanium carbide coating were adopted, respectively. Coating thickness was 20μm in both cases. In the case of carbon coating, stable layer of 20μm was obtained at temperature less than 300°C, but not above 400°C. Therefore, the carbon coating of 20μm was performed at room temperature, 100°C, 200°C and 300°C. Average deposition rate, uniformity of deposition, crystal orientation, surface and cross section morphologies, contained gas species, and chemical composition of coated layer were measured for both carbon and TiC coating. Thermal cycles test was also performed. The coated substrates were heated by infrared lamp from an initial temperature c° 100°C to a highest temperature of 1100°C for 10 sec. The carbon layer peeled off after only one cycle. The titanium carbide layer partially peeled off with 10--100 cycles. These results show that titanium carbide coated with the HCD-PVD method is promising as a surface material for molybdenum first wall. The improvement of adhesion characteristics, however, is still left for a future research.

26726 **(Juel—1993) Stochastic field line structures appearing in field line tracing calculations for a helical magnetic limiter on TORE SUPRA.** Fuchs, G.; Steffen, B.; Blenski, T.; Grosman, A.; Samain, A. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Plasmaphysik; Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Zentralinstitut fuer Angewandte Mathematik; Association Euratom-CEA, Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Recherches sur la Fusion Controlee). May 1985. 41p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86751110.

The influence on the structure of the magnetic field of a tokamak produced by small helical currents flowing near the plasma in TORE SUPRA was investigated numerically by drawing Poincare plots. The current in the helical conductors, the pitch of the windings, the rotational transform and the plasma pressure have been varied. The topology of the magnetic field line structure is discussed in some detail and simple examples are given for illustration.

26727 **(Juel—2002) Materials for heat flux components of the first wall in fusion reactors.** Hoven, H.; Koizlik, K.; Linke, J.; Nickel, H.; Wallura, E. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorwerkstoffe und Heisse Zellen). Aug 1985. 48p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86751109.

Materials of the First Wall in near-fusion plasma machines are subjected to a complex load system resulting from the plasma-wall interaction. The materials for their part also influence the plasma. Suitable materials must be available in order to ensure that the wall components achieve a sufficiently long dwell time and that their effects on the plasma remain small and controllable. The present report discusses relations between the plasma-wall interaction, the reactions of the materials and testing and examination methods for specific problems in developing and selecting suitable materials for highly stressed components on the First Wall of fusion reactors.

26728 **(KFK—3958) ERATO - a computer program for the calculation of induced eddy-currents in three-dimensional conductive structures.** Benner, J. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Kernfusion). Oct 1985. 126p. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE86751105.

The computer code ERATO is used for the calculation of eddy-currents in three-dimensional conductive structures and their secondary magnetic field. ERATO is a revised version of the code FEDIFF, developed at IPP Garching. For the calculation the Finite-Element-Network (FEN) method is used, where the structure is simulated by an gquivalent electric network. In the ERATO-code, the calculation of the finite-element discretization, the eddy-current analysis, and the final evaluation of the results are done in separate programs. So the eddy-current analysis as the central step is perfectly independent of a special geometry. For the finite-element discretization there are two so called preprocessors, which treat a torus-segment and a rectangular, flat plate. For the final evaluation postprocessors are used, by which the current-distributions can be printed and plotted. In the report, the theoretical foundation of the FEN-Method is discussed, the structure and the application of the programs (preprocessors, analysis-program, postprocessors, supporting programs) are shown, and two examples for calculations are presented. (orig.).

26729 (LA—10593-MS) ZT-P: an advanced air core reversed field pinch prototype. Schoenberg, K.F.; Buchenauer, C.J.; Burkhardt, L.C.; Caudill, L.D.; Dike, R.S.; Dominguez, T.; Downing, J.N.; Forman, P.R.; Garcia, J.A.; Giger, A.J. (Los Alamos National Lab., NM (USA)). Jan 1986. Contract W-7405-ENG-36. 67p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE86007204.

The ZT-P experiment, with a major radius of 0.45 m and a minor radius of 0.07 m, was designed to prototype the next generation of reversed field pinch (RFP) machines at Los Alamos. ZT-P utilizes an air-core poloidal field system, with precisely wound and positioned rigid copper coils, to drive the plasma current and provide plasma equilibrium with intrinsically low magnetic field errors. ZT-P's compact configuration is adaptable to test various first wall and limiter designs at reactor-relevant current densities in the range of 5 to 20 MA/m^2. In addition, the load assembly design allows for the installation of toroidal field divertors. Design of ZT-P began in October 1983, and assembly was completed in October 1984. This report describes the magnetic, electrical, mechanical, vacuum, diagnostic, data acquisition, and control aspects of the machine design. In addition, preliminary data from initial ZT-P operation are presented. Because of ZT-P's prototypical function, many of its design aspects and experimental results are directly applicable to the design of a next generation RFP. 17 refs., 47 figs.

26730 (LA-UR—86-503) Excimer laser development for fusion. Giovanielli, D. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 8p. (CONF-851128—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE86007385.

From 17. European conference on laser interaction with matter; Rome, Italy (18 Nov 1985).

The future utility of inertial confinement fusion requires a new driver. Successful experiments coupling laser energy to targets, and our understanding of fuel capsule behavior strongly suggest that a laboratory thermonuclear source is attainable and power production may be considered if a suitable driver with high efficiency, high repetition rate, and most importantly, low capital cost, can be identified. No adequate driver exists today; however, the krypton fluoride laser holds great promise. By the end of this decade, driver development can be brought to the point that a technically justifiable choice can be made for the future direction of ICF.

26731 (LA-UR—86-866) Fiber-optic control of the ZT-P experiment. Caudill, L.D.; Chandler, G.I.; Hall, C.R.; Trujillo, J.F. (Los Alamos National Lab., NM (USA)). 1986. Contract W-7405-ENG-36. 14p. (CONF-860324—20). NTIS, PC A02/MF A01; GPO Dep. File Number DE86008719.

From High temperature plasma diagnostics; Hilton Head Island, SC, USA (9 Mar 1986).

The computer control system for the ZT-P experiment has been implemented using a fiber-optic link in all 161 control signal paths. Four classes of control signals are used in this design. These are: (a) digital-out, an on-off signal from computer to machine actuator, (b) digital-in, an on-off signal from machine sensor to computer, (c) analog-out, a 0 to 10 volt analog signal from computer to machine actuator, (d) analog-in, a 0 to +1 milliampere analog signal from machine sensor to computer. The digital-in and the digital-out class of signals require no control power at the machine. The analog-out and the analog-in class of signals use available machine power for control. This unique power arrangement and the use of fiber-optic links totally isolate the electrically noisy machine areas from the sensitive electronics in the computer control. Advantages of this system including low cost, small size, personnel safety, and ease of maintenance and modification are discussed.

26732 (LA-UR—86-867) Magnetic-fusion data acquisition at Los Alamos. Wilkins, R.W.; Klare, K.A. (Los Alamos National Lab., NM (USA)). 1986. Contract W-7405-ENG-36. 12p. (CONF-860324—17). NTIS, PC A02/MF A01; GPO Dep. File Number DE86008720.

From High temperature plasma diagnostics; Hilton Head Island, SC, USA (9 Mar 1986).

The CTR division uses a single software package to acquire data from hundreds of CAMAC recorders. For the past five years, this package has been used by all experiments, both manual and computer controlled. A variety of signals are stored in transient digitizers and other memories. The computer retrieves the data and applies an efficient compression algorithm before storing it on disk. The physicist can plan his next shot from the acquired data even as the rest is read. The readout is list-directed with device, amplifier, and time base types and their settings selected by the physicist. A new experiment may be set up in minutes.

26733 (LA-UR—86-868) General distributed control system for fusion experiments. Klingner, P.L.; Levings, S.J.; Wilkins, R.W. (Los Alamos National Lab., NM (USA)). 1986. Contract W-7405-ENG-36. 12p. (CONF-860324—21). NTIS, PC A02/MF A01; GPO Dep. File Number DE86008721.

From High temperature plasma diagnostics; Hilton Head Island, SC, USA (9 Mar 1986).

A general control system using distributed LSI-11 microprocessors is being developed. Common software residues in each LSI-11 and is tailored to an application by control specifications downloaded from a host computer. The microprocessors, their control interfaces, and the micro-to-host communications are CAMAC based. The host computer also supports an operator interface, coordination of multiple microprocessors, and utilities to create and maintain the control specifications. Typical applications include monitoring safety interlocks as well as controlling vacuum systems, high voltage charging systems, and diagnostics.

26734 (LA-UR—86-869) Magnetic-fusion data analysis at Los Alamos. Klare, K.A. (Los Alamos National Lab., NM (USA)). 1986. Contract W-7405-ENG-36. 12p. (CONF-860324—18). NTIS, PC A02/MF A01; GPO Dep. File Number DE86008722.

From High temperature plasma diagnostics; Hilton Head Island, SC, USA (9 Mar 1986).

DAD is a versatile, easy-to-use, easy-to-modify set of programs for Data Analysis and Display. The physicist simply calls a program by its name and a few numbers, which will tell the device, shot, or operation needed. Each command invokes a separately compiled program. This allows each experimenter to write commands to display model calculations or particular devices. Typical displays include: raw and normalized signals, or derived results such as phase-modulation detection Thomson scattering nonlinear fits, wall temperatures from thermocouple conversions, and ion temperatures from Doppler broadening of spectral lines. Multiple-device and multiple-shot displays of single-channel or quadrature signals show progressions otherwise hard to find. Some programs have three-dimensional displays with contour or surface plots. The shots available on disk and device settings during data recording can be listed; analysis parameters may be shown or set. One number can define a whole series of commands. ODD is a calculator-like program to quickly process data and graph results for user needs that have not been reduced to a standard program. These programs use a shared library on Prime and VAX computers.

26735 (LA-UR—86-922) Lethality test system. Parsons, W.M.; Sims, J.R.; Parker, J.V. (Los Alamos National Lab., NM (USA)). 1986. Contract W-7405-ENG-36. 5p. (CONF-8604147—5). NTIS, PC A02/MF A01; GPO Dep. File Number DE86008733.

From 3. symposium on electromagnetic launch technology; Austin, TX, USA (20 Apr 1986).

The Lethality Test System (LTS), presently under construction at Los Alamos, is an electromagnetic launcher facility designed to perform impact experiments at velocities up to 15 km/s. The launcher is a 25 mm round bore, plasma armature railgun extending 22 m in length. Preinjection is accomplished with a two-stage gas gun capable of 7 km/s. The railgun power supply utilizes traction motors, vacuum interrupters, and pulse transformers. An assembly of 28 traction motors, equipped with flywheels, stores approximately 80 MJ at 92% of full speed and energizes the primary windings of three pulse transformers at a current of 50 kA. At peak current an array of vacuum interrupters disconnects the transformer primary windings and forces the current to flow in the secondary windings. The secondary windings are connected to the railgun,

and by staging the vacuum interrupter openings, a 1 MA to 1.3 MA ramped current waveform will be delivered to the railgun.

26736 (LA-UR—86-925) Himass electromagnetic launcher at Los Alamos. Zimmermann, E.L.; Fowler, C.M.; Foley, E.; Parker, J.V. (Los Alamos National Lab., NM (USA)). 1986. Contract W-7405-ENG-36. 4p. (CONF-8604147—6). NTIS, PC A02/MF A01; GPO Dep. File Number DE86008734.

From 3. symposium on electromagnetic launch technology; Austin, TX, USA (20 Apr 1986).

The HIMASS electromagnetic launcher is a unique large-bore, large-mass railgun driven by a helical flux compression generator. Two experiments were conducted at 3 to 4 MA current levels. The objective of the experiments was to study the effects of scaling, ablation, and material parameters on electromagnetic launcher performance. Data from these two experiments are presented.

26737 (LA-UR—86-926) Railguns powered by explosive driven flux compression generators. Fowler, C.M.; Zimmermann, E.L.; Cummings, C.E.; Davidson, R.F.; Foley, E.; Hawke, R.S.; Kerrisk, J.F.; Parker, J.V.; Parsons, W.M.; Peterson, D.R. (Los Alamos National Lab., NM (USA); Lawrence Livermore National Lab., CA (USA); Texas Univ., Austin (USA). Center for Electromechanics). 1986. Contract W-7405-ENG-36. 7p. (CONF-8604147—8). NTIS, PC A02/MF A01; GPO Dep. File Number DE86008735.

From 3. symposium on electromagnetic launch technology; Austin, TX, USA (20 Apr 1986).

Explosive driven flux compression generators (FCG's) are single-shot devices that convert part of the energy of high explosives into electromagnetic energy. Some classes of these generators have served quite well as railgun power sources. In this paper and the following paper we describe strip and helical type FCG's, both of which are in use in the Los Alamos railgun program. Advantages and disadvantages these generators have for railgun power supplies will be discussed, together with experimental results obtained and some of the diagnostics we have found particularly useful.

26738 (LA-UR—86-1005) Nonequilibrium statistical theory of bubble nucleation and growth under neutron and proton irradiation. Yu, J.; Sommer, W.F.; Bradbury, J.N. (Los Alamos National Lab., NM (USA)). 1986. Contract W-7405-ENG-36. 22p. (CONF-860421—9). NTIS, PC A02/MF A01; GPO Dep. File Number DE86008750.

From 2. international conference on fusion reactor materials (ICFRM-2); Chicago, IL, USA (13 Apr 1986).

Microstructural evolution in metals under particle irradiation is described by a non-equilibrium statistics method. This method gives a set of equations for the evolution of bubbles and an approximate solution for a distribution function of bubble size as a function of fluence and temperature. The distribution function gives the number of bubbles of radius r at time t, $N(r,t)dr$, as a function of size, r/r_0 (r_0 is the radius of a bubble nucleus). It is found that $N(r,t)dr$ increases with fluence. Also, the peak value of $N(r,t)dt$ shifts to higher r/r_0 with increasing fluence. Nucleation depends mainly on helium concentration and defect cluster concentration while bubble growth is controlled mainly by the vacancy concentration and a fluctuation coefficient. If suitable material parameters are chosen, a reasonable distribution function for bubble size is obtained. The helium diffusion coefficient is found to be less than that for vacancies by five orders of magnitude. The fraction of helium remaining in matrix is less than 10^{-2}; the majority of the helium is associated with the bubbles.

26739 (PPPL-Q—42) Princeton Plasma Physics Laboratory annual report, October 1, 1983-September 30, 1984. Phillips, C.A. (ed.). (Princeton Univ., NJ (USA). Plasma Physics Lab.). 1984. Contract AC02-76CH03073. 125p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE86008595.

Progress made during this reporting period is reported for each of the following areas: (1) principal parameters achieved in experimental devices, (2) TFTR, (3) PLT, (4) PBX, (5) S-1 Spheromak, (6) advanced concepts Torus-1, (7) x-ray laser studies, (8) theory, (9) tokamak modeling, (10) reactor studies, (11) spin-polarized fusion program, (12) tokamak fusion core experiment, and (13) engineering. (MOW)

26740 (SAND—85-2754C) Fabrication of pulsed-power-driven x-ray laser targets. Wiemann, D.K.; Bieg, K.W.; Rand, P.B.; Sharp, D.J. (Sandia National Labs., Albuquerque, NM (USA)). 1986. Contract AC04-76DP00789. 6p. (CONF-860330—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE86008773.

From 5. annual target fabrication specialists meeting; Las Vegas, NV, USA (24 Mar 1986).

In the pulsed power driven x-ray laser program at Sandia National Laboratories, a complex cylindrically symmetric target is placed at the center of an imploding gas puff Z-pinch. The targets presently being fabricated are multi-layered, thin-walled annuli ("soda straws") that have nominal dimensions of 2 cm in length by 2 or 3 mm in diameter. The primary target consists of a 2 μm parylene strongback with an inner layer of lasant material such as Cu, and an outer layer of x-ray converter material such as Al. Fabrication of this target involves subsequent PVD coatings onto a lucite mandrel and then etching the mandrel away in acetone. Other configurations replace the parylene strongback with Be or a parylene/low density foam combination. The different lasant/converter combinations along with the fabrication process, techniques and problems of the parylene "soda straws" will be presented. Procedures and problems with the Be and the parylene/foam "soda straw" fabrication will be presented.

26741 (UCID—20559-Vol.1) MINIMARS conceptual design: Report I. Volume 1. Lee, J.D. (ed.). (Lawrence Livermore National Lab., CA (USA)). Dec 1985. Contract W-7405-ENG-48. 418p. NTIS, PC A18/MF A01; 1; GPO Dep. File Number DE86006800.

Engineering parameters and by features of MINIMARS are presented. Topics discussed are startup, halo physics, drift pumping, magnet design, shielding, injector systems, electrical systems, fueling systems, free electric laser, blankets, heat tansport, tritium systems, configuration, assembly and maintainence, and cost. 115 refs., 112 figs., 44 tabs. (WRF)

26742 (UCRL—93513) RTNS-II fusion materials irradiation facility. Heikkinen, D.W.; Tuckerman, D.B.; Davis, J.C.; Massoletti, D.J.; Short, D.W. (Lawrence Livermore National Lab., CA (USA)). 1986. Contract W-7405-ENG-48. 9p. (CONF-860421—10). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86008761.

From 2. international conference on fusion reactor materials (ICFRM-2); Chicago, IL, USA (13 Apr 1986).

The Rotating Target Neutron Source (RTNS-II) facility provides an intense source of 14-MeV neutrons for the fusion energy programs of Japan and the United States. Each of the two identical accelerator-based neutron sources is capable of providing source strengths in excess of 3×10^{13} n/s using deuteron beam currents up to 150 mA. The present status of the facility, as well as the various upgrade options, will be described in detail.

26743 (UCRL—93946) Fusion product energy spectra in beam heated D-D, D-T, and D-^{3}He plasmas. Slaughter, D. (Lawrence Livermore National Lab., CA (USA)). Mar 1986. Contract W-7405-ENG-48. 4p. (CONF-860412—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86008762.

From 13. European conference on controlled fusion and plasma heating; Schliersee, F.R. Germany (14 Apr 1986).

One of the critical parameters in large scale fusion experiments is the ion speed distribution and its variation with changes in confinement and heating. Large plasma dimensions and high densities complicate direct measurement of this distribution since ions escaping to the wall are primarily those which undergo charge exchange in the outer plasma or those which have suffered many collisions and significant energy loss during their migration from the central plasma. Several previous works have shown that neutron and proton fusion reaction products generate a spectral line which is fairly broad due to Doppler broadening.

26744 Conceptual design of a moving-ring reactor. Smith, A.C.; Carlson, G.A.; Ashworth, C.P.; Abreu, K.E.; Fleischmann, H.H.; Schultz, K.R.; Wong, C.P.C.; Bhadra, D.K.; Creedon, R.L.; Cheng, E.T. (Lawrence Livermore National Lab., Univ. of California, Livermore, CA 94550). *Fusion Technology;* 9: No. 1, vp(Jan 1986). Contract W-7405-ENG-48.

A design of a prototype moving-ring reactor was completed, and a development plan for a pilot reactor is outlined. The fusion fuel is confined in current-carrying rings of magnetically field-reversed plasma ("compact toroids"). The plasma rings, formed by a coaxial plasma gun, undergo adiabatic magnetic compression to ignition temperature while they are being injected into the reactor's burner section. The cylindrical burner chamber is divided into three "burn stations." Separator coils and a slight axial guide field gradient are used to shuttle the ignited toroids rapidly from one burn station to the next, pausing for one-third of the total burn time at each station. Deuterium-tritium-^{3}He ice pellets refuel the rings at a rate that maintains constant radiated power. The fusion power per ring is $\approx$105.5 MW. The burn time to reach a fusion energy gain of Q = 30 is 5.9 s.

26745 Review of experimental spheromak research and future prospects. Yamada, M. (Princeton Plasma Physics Lab., Princeton Univ., Princeton, NJ 08544). *Fusion Technology;* 9: No. 1, vp(Jan 1986).

A review of experimental spheromak research is presented, together with prospects of near-future experiments and some reactor considerations. In the several experiments based on different schemes, a major effort has recently been made to improve the global magnetohydrodynamic stability and plasma parameters. Electron temperatures sufficiently high to exceed the low-Z radiation barrier have been achieved, and the extensive study of the transport characteristics has begun, aiming to attain more reactor-relevant plasmas with larger current. Finally, an improved conceptual design of a small spheromak reactor is presented, based on a flux injection technique recently developed at the Princeton Plasma Physics Laboratory.

26746 Simple liquid-metal blankets for linear magnetic fusion reactors. Terry, W.K.; Paperman, E.B. (Purdue Univ., School of Nuclear Eng., W. Lafayette, IN 47907). *Fusion Technology;* 9: No. 1, vp(Jan 1986).

Summaries are presented of four conceptual design studies for linear magnetic fusion reactors with simplified blankets mainly consisting of liquid metal. These designs form an evolutionary sequence of increasing complexity. The first concept involves a high-density plasma thermally insulated by a magnetic field, but confined by direct contact with a structureless free-surface blanket of liquid metal. The second concept replaces the wall-confined plasma by a lower density magnetically confined field-reversed configuration translated into an axial cavity in a free-surface liquid-metal blanket. The third concept adds a simple cylindrical shell as a first wall. The fourth concept divides the liquid-metal blanket into two regions of differing axial flow speed. Each step in this sequence is motivated by some short-coming in the preceding design; however, the final design continues to appear attractive.

26747 Review of the Los Alamos FRX-C experiment. Siemon, R.E.; Armstrong, W.T.; Barnes, D.C.; Bartsch, R.R.; Chrien, R.E.; Cochrane, J.C.; Hagrass, W.N.; Kewish, R.W.; Klingner, P.L.; Lewis, H.R. (Los Alamos National Lab., P.O. Box 1663, Los Alamos, NM 87545). *Fusion Technology;* 9: No. 1, vp(Jan 1986).

The FRX-C device is a large field-reversed theta pinch experiment with linear dimensions twice those of its FRX-A and FRX-B predecessors. It is used to form field-reversed configurations (FRCs), which are high-beta, highly prolate compact toroids. The FRX-C has demonstrated an R^2 scaling for particle confinement in FRCs, indicating particles are lost by diffusive processes. Particle losses were also observed to dominate the energy balance. When weak quadrupole fields were applied to stabilize the n = 2 rotational mode, FRC lifetimes >300μs were observed. Detailed studies of the FRC equilibrium were performed using multichord and holographic interferometry. Measurements of electron temperature by Thomson scattering showed a flat profile and substantial losses through the electron channel. The loss rate of the internal poloidal flux of the FRC was observed to be anomalous and to scale less strongly with temperature than predicted from classical resistivity.

26748 Formation of field-reversed configurations using scalable, low-voltage technology. Hoffman, A.L.; Milroy, R.D.; Slough, J.T.; Steinhauer, L.C. (Spectra Tech., Inc., 2755 Northup Way, Bellevue, WA 98004). *Fusion Technology;* 9: No. 1, vp(Jan 1986).

Field-reversed configurations are compact toroids confined solely by poloidal fields. Recent experiments and numerical calculations have demonstrated that they can be formed in field-reversed theta pinches on time scales longer than the radial Alfven time. This considerably eases the technological requirements for large devices, and permits reasonable formation schemes to be developed for future experiments. Scaling laws are developed for both flux trapping and heating effectiveness as a function of the formation time scale and poloidal flux level.

26749 Numerical calculation of equilibria for the field-reversed configuration. Shumaker, D.E. (Lawrence Livermore National Lab., National Magnetic Fusion Computer Center, Livermore, CA 94550). *Fusion Technology;* 9: No. 1, vp(Jan 1986). Contract W-7405-ENG-48.

A two-dimensional magnetohydrodynamic equilibria code is used to demonstrate how the properties of the equilibria depend on the input quantities. This code uses adiabatic quantities as inputs, which are entropy and magnetic flux. With the magnetic flux held constant, it is shown that the length of the separatrix is a smooth function of the total entropy. It is shown that the shape of the separatrix can be changed from eliptical to racetrack by changing the profile of the entropy function. This code can also be used for flux and wall compression since the equilibria are determined by adiabatic quantities. Examples of flux and wall compression are presented. An equilibrium is compared with data from the FRX-C experiment.

26750 Design of a translating field-reversed configuration reactor. Vlases, G.C.; Rowe, D.S. (Univ. of Washington, Dept. of Nuclear Eng., Benson Hall, BF-10, Seattle, WA 98195). *Fusion Technology;* 9: No. 1, vp(Jan 1986).

A compact fusion reactor design with magnetic confinement based on a field-reversed configuration is described. The reactor is linear and operates in a pulsed mode where the plasma moves as a translating "plasmoid" through the burn chamber. The plasma physics model incorporates recent theoretical and experimental results on confinement. The design is compact and its power output is limited by first-wall and blanket technology. A helium-cooled solid breeder blanket is used for tritium breeding and thermal energy removal. A graphite thermal shield is included to reduce the energy generation and resulting first-wall stresses during pulsed operation. These studies indicate that attractive designs in the range of 300 to 1000 MW(electric) are possible, provided that currently understood scaling laws extrapolate favorably into the reactor regime. Multidimensional neutronics analysis indicates tritium breeding ratios >1.0.

26751 A one-dimensional hybrid code for field-reversed mirror dynamics. Stark, R.A.; Miley, G.H. (Naval Surface Weapons Center, Silver Springs, MD). *Nuclear Science and Engineering;* 92: No. 1, vp(Jan 1986).

A one-dimensional radial hybrid code was written to study the start-up of the field-reversed mirror via neutral beam injection. This code, named FROST (Field-Reversed One-dimensional STart-up), models the plasma as azimuthally symmetric with no axial dependence. A multigroup method in energy and canonical angular momentum describes the large orbit ions from the beam. This method is designed to be more efficient than those employing particle tracking, since the characteristic time scale of the simulation is the ion slowing down time, rather than the much shorter cyclotron period. A time-differentiated Grad-Shafranov equation couples the ion current to massless fluid equations describing electrons and low-energy ions. Flux coordinates are used in this fluid model, in perference to a Eulerian framework, so that coupling of plasma at the two different radii of a closed flux surface can be treated with ease.

Since a fluid treatment for electrons is invalid near a field null, a separate model for the electron current was included for this region, which is a unique feature. Results of simulation of injection into a 2XIIB-like plasma are discussed. Electron currents are found to retard, but not prevent, reversal of the magnetic field at the plasma center.

26752 **A deuterium-tritium ignition ramp for an advanced fuel field-reversed configuration reactor.** Zubrin, R.M. (Univ. of Washington, Dept. of Nuclear Eng., Seattle, WA 98195). *Fusion Technology;* 9: No. 1, vp(Jan 1986).

The possibility of using small initial charges of tritium and ^{3}He to boost a deuterium field-reversed configuration (FRC) up to temperatures at which deuterium-deuterium (D-D) ignition can take place is examined. A computer program is used to track the rates of production, reaction, and leakage of the FRC plasma's isotopic constituents as the burn progresses and the FRC's temperature, density, and volume vary. On the basis of these studies and current scaling laws, a highly attractive advanced fuel FRC reactor is outlined. It is cylindrical, 12 m long, and 3.2 m in coil outer radius, and produces 1568 MW(electric), giving it an effective core power/volume ratio as great as a pressurized water reactor. No lithium blanket is required, as the tritium needed for startup can be bred by the D-D reactions themselves.

26753 **Physics requirements for an attractive magnetic fusion reactor.** Sheffield, J. (Oak Ridge National Lab., TN, USA). *Nuclear Fusion;* 25: No. 12, 1733-1743(Dec 1985).

The plasma parameters beta $<\beta>$ and thermal diffusivity chisub(E) required for a self-sustained deuterium-tritium (D-T) reactor plasma may be written in terms of the geometry and technological requirements of the reactor. While there are, separately, constraints on each parameter, it is instructive to combine them in a single parameter $<\beta>$/chisub(E) to characterize the reactor region. In a separate study of a generic toroidal magnetic fusion reactor it has been found that, for a fusion reactor to be competitive with alternative sources of electricity, it must have a fusion island weight of not more than half that of the Starfire and Mars reference reactors. A simple model, based upon this result, is used to determine the region of minimum $<\beta>$/chisub(E) and the self-consistent physics and technology requirements for a reactor as a function of its plasma geometry. The requirements are compared with experimental achievements and theoretical predictions for the parameters $<\beta>$, chisub(E), and $<\beta>$/chisub(E), for a variety of magnetic configurations - tokamak, stellarator, reversed-field pinch, bumpy torus, tandem mirror, and field-reversed theta pinch. It is shown that all these configurations are, 'classically', capable of reaching the attractive reactor region and that good progress is being made experimentally towards that goal.

26754 **Theory and modelling of helium enrichment in plasma experiments with pump limiters.** Prinja, A.K.; Conn, R.W. (California Univ., Los Angeles, USA. Center for Plasma Physics and Fusion Engineering). *Nuclear Fusion;* 25: No. 12, 1775-1782(Dec 1985).

Helium enrichment in the exhaust gas stream flowing from a hydrogen-helium plasma is studied using an analytical theory and Monte Carlo simulations. To provide a sensitive experimental test in a tokamak, an unusual configuration, inverted from traditional designs, is proposed for a pump limiter. The principle can be tested in other plasma devices as well. The theory suggests that for typical plasma edge conditions in a confinement device, namely $n=10^{13}cm^{-3}$ and Tsub(i)=Tsub(e) approx.= 5-30 eV, helium enrichment in the neutral gas exhaust stream can be very high, in the range 5-7, relative to the helium-hydrogen ratio in the plasma. Such high enrichment factors are achieved by exploiting the difference between the ionization rates of hydrogen and helium and the negligible helium charge-exchange rate at these plasma conditions. A limiter arrangement is proposed in which the natural curvature of the toroidal magnetic field is used to isolate, using the plasma itself, the point of plasma neutralization from the location of the gas exhaust. The plasma region then acts to preferentially screen the recycling hydrogen by the processes of ionization and of charge-exchange-induced losses at open boundaries. Theory and analysis suggest that an experiment can provide a sensitive test of models used to describe the plasma edge and of the atomic and surface physics data used in these models.

26755 **Radial charge distribution of the heavy ion fusion cesium ion beam derived from electron beam probe Measurements.** Lampel, M. (Lawrence Berkeley Laboratory, University of California, Berkeley, CA). pp 45 of 1983 IEEE interaction conference on plasma science. New York, NY; IEEE (1983). (CONF-830590—).

From IEEE international conference on plasma science; San Diego, CA, USA (25 May 1983).

Abstracts Only.

The Cesium ion beam from the Heavy Ion Fusion (HIF) injector has been studied with the Electron Beam Probe (EBP). A computer code has been developed to derive the radial charge distribution (including trapped secondary electrons) of the beam. This code uses a six parameter model distribution in conjunction with a particle tracking section to mimic experimental observations; the relation of experimental data to the radial charge distribution is nonlinear precluding inversion techniques such as Abel inversion. This paper discusses the inversion process used and presents results for the case of the HIF injector beam.

99 GENERAL AND MISCELLANEOUS

26756 **(CONF-650335—) Fourth annual power use conference: proceedings.** (Bonneville Power Administration, Portland, OR (USA)). 1965. 92p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE86008036.

From 4. annual power use conference; Portland, OR, USA (31 Mar 1965).

Ten papers are included, on a variety of topics related to power utilization, marketing, demand, sales, and rates. (DLC)

26757 **(CONF-860581—2) Defining the specialized audience for technical publications.** Harmon, J.E. (Argonne National Lab., IL (USA)). 1986. Contract W-31-109-ENG-38. 7p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86007523.

From 33. international technical communication conference; Detroit, MI, USA (11 May 1986).

Before writing a scientific or technical document, the author should decide who the potential readers are and then tailor the level of technical detail to best reach that audience. As discussed in this paper, determining the audience is easy.

26758 **(LA-UR—86-784) Printing considerations for nonprinters.** Webb, G.W. (Los Alamos National Lab., NM (USA)). 1986. Contract W-7405-ENG-36. 5p. (CONF-860581—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86007366.

From 33. international technical communication conference; Detroit, MI, USA (11 May 1986).

This paper explains the basics of printing to editors, graphic artists, and others who prepare copy for the printer. It discusses pre-press requirements, paper selection, printing methods, and finishing options.

26759 **(SAND—85-1488C) Continuing education for the technical staff at Sandia, Albuquerque.** Love, S.L. (Sandia National Labs., Albuquerque, NM (USA)). 1986. Contract AC04-76DP00789. 5p. (CONF-860586—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86007706.

From World conference on continuing education; Lake Buena Vista, FL, USA (7 May 1986).

Sandia has a variety of programs to provide continuing education for its technical staff of 5800 engineers, technicians, and scientists in Albuquerque. The importance of these programs to the technical vitality of the Laboratory is evident in the extensive management support they receive. Offerings include on-premises programs designed to meet the job needs of staff and technical support employees, and a wide variety of off-premises educational assistance programs which are important to the Laboratories' mission. As is the case nationally, the expanding demand for educational services is causing a growing dependence on delivery technologies. This paper describes the on-premises technical education programs and educational technologies within the Laboratories.

26760 (UCID—20622-86-1) Chemistry research resource. Progress report, January 1986. (Lawrence Livermore National Lab., CA (USA)). Feb 1986. Contract W-7405-ENG-48. 94p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE86008765.

The research is reported in twelve sections: synthesis of new materials, development of analytical techniques, chemical kinetics and transport processes, cryogenic and other physical properties of hydrogen isotopes, artificial intelligence, characterization techniques development, materials modeling analysis, mechanical properties of polymers, physical metallurgy (mechanical properties), physical metallurgy (phase transformations), surface modification and surface studies, and new materials development and properties. (DLC)

26761 (UCRL—93954) Future skills/current teaching: microworlds for thinking. Sesko, S.C. (Lawrence Livermore National Lab., CA (USA)). 31 Jan 1986. Contract W-7405-ENG-48. 35p. (CONF-860254—1). NTIS, PC A03/MF A01; GPO Dep. File Number DE86006297.

From Northwest Council on Computer Education conference; Seattle, WA, USA (6 Feb 1986).

Technology has changed and is changing the kinds of skills needed to become employable in our society. In this paper, I describe the skills that are sought by industry and business today, and suggest a curriculum designed to develop these skills using LOGO and LOGO-like microworlds. 38 refs., 1 tab.

9901 Management

REFER ALSO TO CITATION(S) 25333, 25711

26762 (AD-A—162532/6/XAB) Rough handling tests. Final report on International Test Operations Procedure. (Army Test and Evaluation Command, Aberdeen Proving Ground, MD (USA)). 13 Dec 1985. 31p. (ITOP—4-2-602). NTIS, PC A03/MF A01.

This document provides test procedures to simulate the transportation of items carried as unsecured cargo in trucks, or on the person of Army personnel. Items include munitions, rifles, rockets, radios, and mortars. Vibration testing, airdrop capability, and airdrop capability of explosives are not covered in this ITOP. This ITOP provides guidance for testing the ability of military items to withstand the shocks encountered during transportation to or employment on the battlefield.

26763 (AD-A—162924/5/XAB) Distributed rf sensor systems for battle group defense. Final report. (Technology Service Corp., Santa Monica, CA (USA)). Aug 1985. 63p. NTIS, PC A04/MF A01.

As exemplified by the Falkland's war, a stationary battle group is especially vulnerable to attack by small, low-flying missiles. Shipboard sensors are unable to provide timely alerting of such an attack to the various defensive elements because the low-flying attacking missile is over the horizon and invisible to radars until it pops over the horizon near the ships. Even at the time, it is difficult to see because it is lost in background sea clutter. An early alerting technique is needed. The concept is that of a fence of radar buoys, deployed in an arc at 65 km to 130 km from the ship group in a direction identified as a potential threat axis. The buoys would be expendable, operate for 10 hours on station, by deployed by P-3 or S-2 ASW aircraft, and would communicate detection alarms to the ship group by HF radio.

26764 (AD-A—163086/2/XAB) Advanced Planning Briefing for Industry (APBI) (1985). Special publication for period ending October 1985. Dimmick, R.L.; Hinkle, R.P. (Chemical Research and Development Center, Aberdeen Proving Ground, MD (USA)). Nov 1985. 330p. (CRDC-SP—86001). NTIS, PC A15/MF A01.

This publication is a compilation of the presentations given at the 1985 Advanced Planning Briefing for Industry (APBI), held at CRDC, Edgewood Area, Aberdeen Proving Ground, in October 1985. This briefing covered specific aspects of the CRDC programs and provided industry with mission-oriented scientific and technical information. Programs were presented by CRDC personnel and were attended by contractors and potential government contractors. Presentations included briefing on: An Overview of the Chemical Research and Development Center; NBC Contamination Survivability of Army Materiel; Basic Research Opportunities; Individual Protection; NBC Contamination; Collective Protection; Detection Standoff and Point; Smoke and Obscuration Systems; Computer Aided Design/Computer Aided Engineering.

26765 (AD-A—163304/9/XAB) Analysis of off-shore fuel-handling technology. Final technical report, May-October 1985. Hamlin, F.J.; Jones, M.E.; Durfee, J.H. (BDM Corp., Vienna, VA (USA)). Dec 1985. 71p. (BDM/W—85-816-TR). NTIS, PC A04/MF A01.

This report describes the current Army method for delivery of bulk fuels over the shore in an undeveloped theater and details deficiencies in the system. Also described are programed improvements in the near term intended to correct certain deficiencies with regard to contingency-planning requirements. The report discusses long-term needs relative to off-shore fuel-handling technology for the Army 21 concept of operations and outlines shortfalls in the system for meeting those needs. Several alternative concepts are proposed to alleviate shortfalls. Conclusions and recommendations are presented.

26766 (AD-A—955006/2/XAB) Life-cycle costing guide for system acquisitions. Interim guide. (Wisconsin Univ., Madison (USA). Dept. of Geological Sciences). Jan 1973. 90p. (LCC—3). NTIS, PC A05/MF A01.

The Life Cycle Cost (LCC) of a system is the total cost to the Government of acquisition and ownership of that system over its full life. It includes the cost of development, acquisition, operation, support and where applicable, disposal. However, in certain applications of this Guide, such as LCC estimation for purposes of contractual commitments, source selection and choices among design alternatives, LCC is generally used to examine only relevant costs. For the purpose of this Guide, a complete system is defined as a major end item and all the components required for its operation and support, including relevant facilities, equipment, materiel, data, personnel and services. (Note: The Guide is applicable to hardware systems which are weapon systems, communication systems).

26767 (CONF-860584—1) Database administration in a matrix organization: playing the game and coaching the team. Roseberry, L.M. (Oak Ridge National Lab., TN (USA)). Feb 1986. Contract AC05-84OR21400. 7p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86007565.

From American Society for Information Science's mid-year meeting; Portland, OR, USA (11 May 1986).

This paper answers the following questions: What's the name of the data management game; what position do I play; what are the rules; how do I lose; and how do I win.

26768 (EGG-SSDC—31) Process of task analysis. Blackman, H.S.; Gertman, D.I.; Haney, L.N. (EG and G Idaho, Inc., Idaho Falls (USA)). Sep 1985. Contract AC07-76ID01570. 32p. NTIS, PC A03/MF A01; GPO Dep. File Number DE86008183.

The paper presents a task analysis form for the organization of task analysis efforts. In terms of the form, task descriptions for use in task analysis data collection are given, and detailed definitions of 35 task analysis categories are offered. The categories include important aspects of task performance, consequences, and feedback, as well as aspects of training and knowledge requirements. Methods behind the derivations of tasks and subtasks, and category analysis are explained. Aspects of data applications concerning who and how are discussed. Task analysis can be used in the development of behavioral learning objectives and instructional strategies. Action verbs are often used in category analysis and human capabilities identification. Curriculum and tests may be developed by analyzing what people do and need in their jobs. The process of task analysis is a useful tool in the analysis and improvement of human job performance.

26769 (RISO-M—2433) Contribution of Risoe National Laboratory to the research development programs of the Danish Ministry of Energy. Status per December 1983. (Risoe National Lab., Roskilde (Denmark)). Jun 1984. 67p. (In Danish). NTIS (US Sales Only), PC A04/MF A01. File Number DE86701644.

Since 1978 Risoe has been responsible for a number of projects in the research and development programs of the Danish Ministry of Energy. This report gives a review of current and finished projects. All current projects are described briefly, stating status and results obtained, while results of finished projects are described in more detail. Risoe'e contribution of the organization and the administration of the programs is mentioned. Finally a list of references is given.

26770 (RISO-M—2514) Contribution of Risoe National Laboratory to the research development programs of the Danish Ministry of Energy. Status per December 1984. (Risoe National Lab., Roskilde (Denmark)). Jul 1985. 79p. (In Danish). NTIS (US Sales Only), PC A05/MF A01. File Number DE86701645.

Since 1978 Risoe has been responsible for a number of projects in the research and development programs of the Danish Ministry of Energy. This report gives a review of current and finished projects. All current projects are described briefly, stating status and results obtained, while the results of finished projects are described in more detail. Risoe's contribution of the organization and the administration of the programs is mentioned. Finally a list of references is given.

26771 (RISO-M—2529) List of selected publications 1983. Risoe National Laboratory. (Risoe National Lab., Roskilde (Denmark)). Sep 1985. 54p. NTIS (US Sales Only), PC A04/MF A01. File Number DE86701646.

The list comprises a selection of scientific and technical publications of Risoe National Laboratory and its staff during 1983. Journal articles, conference papers, and reports are included. The publications are arranged in the following broad subject categories: Energy Supply and Supporting Technology, Environmental and Safety Research, Materials Research, Biotechnology and Tradiation Research, Technical Support, General.

26772 (SSDC—30) Human factors management. Nertney, R.J.; Fillmore, D.L. (EG and G Idaho, Inc., Idaho Falls (USA). System Safety Development Center). Jul 1985. Contract AC07-76ID01570. 44p. NTIS, PC A03/MF A01; GPO Dep. File Number DE86008184.

Evaluating a system to determine if it has the right people working using the right procedures and management controls with the right hardware at all times is the facet of human factors discussed in this manual. The following areas of concern are specifically addressed: (1) the selection process must be proper to select qualified workers who are given proper training for the work and whose skills are maintained; (2) a proper behavioral climate must be established at the work station; (3) all task assignments must contain elements of instruction and training; and (4) all supporting systems must interact with the human to ensure that the work can be completed. All of these areas of concern can be successfully completed using the existing company organization by following the considerations presented in this document and maintaining proper interfaces between the different branches of the company.

26773 (SSDC—34) Basic human factors considerations. Nertney, R.J.; Fillmore, D.L. (EG and G Idaho, Inc., Idaho Falls (USA). System Safety Development Center). Dec 1985. Contract AC07-76ID01570. 37p. NTIS, PC A03/MF A01; GPO Dep. File Number DE86008181.

Models and concepts for analyzing the human element in working programs and systems are introduced. The method of attack is a functional one based on analysis of the work to be done (job-task analysis). Based on the results of the job-task analysis, psychological and physiological requirements and criteria can be defined for the system.

9902 Mathematics And Computers

REFER ALSO TO CITATION(S) 25630, 26004

26774 (AD-A—163187/8/XAB) Impact of parallel architectures on the solution of eigenvalue problems. Research report. Ipsen, I.C.F. (Yale Univ., New Haven, CT (USA). Dept. of Computer Science). Dec 1985. 15p. (YALEU/DCS/RR—444). NTIS, PC A02/MF A01.

The most significant impact on research in Scientific Computation, and Numerical Linear Algebra in particular, seems to have been brought about by the advent of vector and parallel computation. This paper presents a short survey of recent work on parallel implementations of Numerical Linear Algebra algorithms with emphasis on those relating to the solution of the symmetric eigenvalue problem on loosely coupled multiprocessor architectures. A simple model given to analyze the complexity of parallel algorithms on several representative multiprocessor systems: a linear processor array (or ring), a two-dimensional processor grid, and the hypercube. The vital operations in the formulation of most eigenvalue algorithms are matrix vector multiplication, matrix transposition, and linear system solution. Their implementations on the above architectures are described, as well as parallel implementations of the following classes of eigenvalue methods: QR, bisection, divide-and-conquer, and Lanczos algorithm.

26775 (AD-A—163195/1/XAB) Highly concurrent scalar processing. Doctoral thesis. Hsu, P.Y. (Illinois Univ., Urbana (USA). Coordinated Science Lab.). Jan 1986. 122p. (UILU-ENG—86-2203). NTIS, PC A06/MF A01.

High-speed scalar processing is an essential characteristic of high-performance general purpose computer systems. Efficient concurrent execution of scalar code is difficult due to data dependencies and conditional branches. This thesis proposes a code-scheduling heuristic called the decision tree scheduling (DTS) technique for general scalar code, and an optimal code scheduling algorithm called the simple loop scheduling (SLS) algorithm for a restricted class of innermost loops. Also proposed is a highly concurrent machine architecture that takes advantage of these scheduling techniques.

26776 (AD-A—163381/7/XAB) US Army MICOM scientific and engineering support computational capabilities requirements analysis study report. Volume 1. Management overview. Appendices. (Inter Systems, Inc., Annandale, VA (USA)). 15 Nov 1985. 83p. NTIS, PC A05/MF A01.

Scientific computers at MICOM (Army Missile Command). This document is a questionnaire from the Army Missile Laboratory. A MICOM Scientific and Engineering Computing Requirements Definition and Analysis Study was approved. The purpose of the study is to determine the near-term and long-term (10 years) scientific and engineering computing requirements in order to establish the sizes (e.g., micros, minis, supers), distribution of computers, terminals, communications networks, as well as software systems and packages required to meet the needs in the most efficient manner. This document has survey and interview forms to be used in each organization to gather data on existing and future applications and hardware. The data will be used to determine the overall requirements.

26777 (AD-A—163425/2/XAB) Interprocessor communication issues in fat-tree architectures. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Electrical Engineering and Computer Science). Oct 1985. 43p. NTIS, PC A03/MF A01.

In recent years, it has become increasingly evident that conventional computer architectures will be unable to perform, in an acceptable time frame, many of the computational functions that we would desire of them. Consequently, much research has been devoted to the concept of constructing supercomputers, which will be able to exploit the potential for parallel computation intrinsic to many large computational problems. Recently, Leiserson has proposed a multiprocessor scheme based on Leighton's tree of meshes, called a fat-tree. Conceptually, such a multiprocessor would be comprised of a set of n processing elements each situated as a leaf

in a complete binary tree. Internal modes would be high speed switches which route messages being passed between processing elements, while edges between nodes would be bundles of constant bandwidth communication paths. This document addresses and defines some of the issues that effect interprocessor communication within a fat-tree multiprocessor. Specifically, it covers the following topics: (1) Addressing in a fat-tree; (2) Generation of addresses in a fat-tree; and (3) Allocation of communication resources in a fat-tree.

26778 **(AERE-R—11877) Implementation of GNASH and auxiliary codes on the Harwell CRAY-1.** Muir, D.W. (UKAEA Atomic Energy Research Establishment, Harwell. Nuclear Physics Div.). Jul 1985. 100p. NTIS (US Sales Only), PC A05/MF A01. File Number DE86701448.

The report describes a version of the preequilibrium, statistical nuclear-model code GNASH which has been implemented, along with a set of small auxiliary codes, on the CRAY-1 at AERE Harwell. GNASH provides a flexible tool for calculating cross sections, isomer ratios and emission spectra. A detailed description of the current user input is provided along with a full listing of the actual FORTRAN code, as modified for this implementation.

26779 **(ANL—86-10) Alternative library under 4.2 BSD UNIX on a VAX 11/780.** Cody, W.J. (Argonne National Lab., IL (USA)). Feb 1986. Contract W-31-109-ENG-38. 32p. NTIS, PC A03/MF A01; GPO Dep. File Number DE86009011.

This paper describes an alternative library of elementary functions prepared for use with the standard Fortran compiler under 4.2 BSD UNIX on a VAX 11/780. The library, written in C and based on the book "Software Manual for the Elementary Functions" by Cody and Waite, offers improved accuracy over the standard system library, as well as additional capabilities. Listings and output from the ELEFUNT suite of test programs are included in the appendix.

26780 **(ANL/MCS-TM—16-Rev.1) User guide for JAKEF. Revision 1.** Hillstrom, K.E. (Argonne National Lab., IL (USA)). Dec 1985. Contract W-31-109-ENG-38. 33p. NTIS, PC A03/MF A01; GPO Dep. File Number DE86007554.

JAKEF is a language processor that accepts as input a single precision or double precision FORTRAN subroutine defining an objective function f(x) or a vector function F(x) and produces as output a single precision or double precision FORTRAN subroutine defining the gradient of f(x) or the Jacobian of F(x). JAKEF accepts as input ANSI 1977 standard FORTRAN subroutines and produces as output ANSI 1977 FORTRAN subroutines. JAKEF itself is written in ANSI 1977 standard FORTRAN, except for the use of an extended character set and transfers of control into an IF-block from outside the IF-block. This report serves as a user guide for the processor.

26781 **(ANL/MCS-TM—17-Rev.1) Installation guide for JAKEF. Revision 1.** Hillstrom, K.E. (Argonne National Lab., IL (USA)). Dec 1985. Contract W-31-109-ENG-38. 13p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86007548.

JAKEF is a language processor that accepts as input a single precision or double precision FORTRAN subroutine defining an objective function f(x) or a vector function F(x) and produces as output a single precision or double precision FORTRAN subroutine defining the gradient of f(x) or the Jacobian of F(x). JAKEF accepts as input ANSI 1977 standard FORTRAN subroutines and produces as output ANSI 1977 FORTRAN subroutines, JAKEF itself is written in ANSI 1977 standard FORTRAN, except for the use of an extended character set and transfers of control into an IF-block from outside the IF-block. This report describes the steps required to implement the processor from the tape on which it is transmitted.

26782 **(BDX—613-3465) DEC VAX remote access to Applicon AGS data.** Harris, D.D. (Allied Corp., Kansas City, MO (USA). Bendix Kansas City Div.). Mar 1986. Contract AC04-76DP00613. 57p. NTIS, PC A04. File Number DE86008857.

This package was developed to eliminate transfer of magnetic tapes between the Applicon CAD system and the VAX-based CAD data post-processor. This was accomplished using a DECnet link between the VAX and the Applicon machine. DEC net is used to transfer data under control of programs running on the VAX A server program, written in MACRO-11, runs on the Applicon to provide access to the specialized Applicon file structure. Using this software package, a VAX user can view a directory of the Applicon database and transfer selected files from the Applicon to the VAX. (WRL)

26783 **(BDX—613-3472) DOE DEF RIM-to-IGES. File Writer documentation manual.** Fritsche, K.L.; Leake, P.S. (Allied Corp., Kansas City, MO (USA). Bendix Kansas City Div.). Mar 1986. Contract AC04-76DP00613. 463p. NTIS, PC A20/MF A01; 1; GPO Dep. File Number DE86007699.

This document will define the design specifications for the RIM-to-IGES File Writer Program. It describes the purpose of the File Writer, lists references, defines the structure of the program, and discusses the Fortran/RIM interface.

26784 **(CONF-860568—1) Fundamentals of computer graphics for artists and designers.** Riley, B.A. (Oak Ridge National Lab., TN (USA)). 1986. Contract AC05-84OR21400. 13p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86007327.

From National Computer Graphics Association meeting; Anaheim, CA, USA (11 May 1986).

This tutorial provides introductory information about computer graphics slanted towards novice users from artist/designer backgrounds. The goal is to describe the applications and terminology sufficiently to provide a base of knowledge for discussions with vendors.

26785 **(CONF-8604110—1) Deriving sequential and parallel programs from pure Lisp specifications by program transformation.** Boyle, J.M.; Dritz, K.W.; Muralidharan, M.N.; Taylor, R.J. (Argonne National Lab., IL (USA)). 1986. Contract W-31-109-ENG-38. 18p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86005555.

From Program specification and transformation IFIP TC2 working conference; Bad Toelz, F.R. Germany (14 Apr 1986).

We describe an "industrial strength" example of the use of specification and transformation to produce an efficient program. The specification is written in pure Lisp. Program transformations have been used to generate from it a program that executes efficiently on a wide variety of sequential machines. Another set of transformations has been used to generate programs from it that execute efficiently on global-memory parallel machines. We discuss some of the design decisions for the parallel version (and their motivations), optimization of parallel programs, and the benefits of the specification-transformation approach.

26786 **(DOE/ER/60138—T4) Demos User's Manual. Version 2.** Henrion, M.; Nair, I. (Carnegie-Mellon Univ., Pittsburgh, PA (USA). Dept. of Engineering and Public Policy). 20 Nov 1982. Contract AC02-83ER60138. 56p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE86006150.

This document provides an introduction to Demos (Decision Modelling System) and a description of its facilities and how to use them. It is written for people who have at least a little experience with interactive computing, but who may not necessarily have any skill in computer programming. To get an initial feel for how to interact with Demos and what the system can do look at Dialog with Demos: An illustrative transcript. We suggest that the beginning user should start by reading this introduction, the illustrative transcript, and at least the sections on Basics (2) and Variables (3). You will then known enough for initial use of the system, and can learn more by consulting the documentation and by experimentation as you go.

26787 (EGG-M—31785) General data base driven graphic animation system. (Idaho National Engineering Lab., Idaho Falls (USA)). 1986. Contract AC07-76ID01570. 9p. (CONF-860568—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86007646.

From National Computer Graphics Association meeting; Anaheim, CA, USA (11 May 1986).

Most attempts at the graphic animation of data involve rather large and expensive development of problem-specific systems. This paper discusses a general graphics animation system designed to be a tool for the development of a wide variety of animated simulations. By incorporating device-independent graphics procedures and using relational database storage of graphics and control information, considerable flexibility in the design and development of animated displays is achieved. 6 refs., 4 figs.

26788 (EIR—539) NJOY nuclear data processing system: The MICROR module. Mathews, D.R.; Stepanek, J.; Pelloni, S.; Higgs, C.E. (Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen (Switzerland)). Dec 1984. 83p. (GA-A—17851). NTIS (US Sales Only), PC A05/MF A01. File Number DE86701449.

The NJOY nuclear data processing system is a comprehensive computer code package for producing pointwise and multigroup neutron and photon cross sections and related nuclear parameters from ENDF/B-IV and V evaluated nuclear data. The MICROR overlay is a reformatting module that produces cross sections library files for the MICROX, MICROX-2 and MICROBURN postprocessor codes. Using the data on the pointwise and groupwise NJOY tapes, MICROR produces the tapes containing basic nuclear data, FDTAPE, GAR and GGTAPE used by two-region spectrum codes MICROX and MICROX-2 and by two-region spectrum burn-up code MICROBURN.

26789 (ENEA-RT/FI—83-5) BOLIK: a code to evaluate correlated data starting by multiple or ratio values. Petilli, M. (ENEA, Casaccia (Italy). Dipartimento Tecnologie Intersettorialli di Base). 1983. 44p. NTIS (US Sales Only), PC A03/MF A01. File Number DE86901000.

This paper presents the first of a series of codes developed for the treatment of data with their variance-covariance matrix. These codes can be considered auxiliary for unfolding codes requiring uncertainties in input data. The code BOLIK is a code which can combine multiple data and/or calculate absolute values of given parameters when ratio measurements are available or measured data are expressed in arbitrary units. The method used by BOLIK is the Least Squares Method, already applied in other problems, such as cross section adjustment and spectra unfolding.

26790 (INER—0530) Application of AIM-65 microcomputer to the processing of the radon detecting data of the alphaCARD system. Huang, K.; Soong, K.L. (Institute of Nuclear Energy Research, Lung-Tan (Taiwan)). Dec 1983. 25p. (In Chinese). NTIS (US Sales Only), PC A02/MF A01. File Number DE86901028.

By interfacing the memory module of the alphaCARD radon detecting system with the AIM-65 microcomputer, the data stored in the memory module of the system can be processed and printed out with a program written in FORTH language. The microcomputer not only takes the place of the optional printer and memory interface of the alphaCARD system, but also privides two additional functions: dumping the data to cassette recorder for permanent storage; and picking out the two count readings of the same card and correcting the counts contributed by thoron.

26791 (INER—0553) Fetching and processing of the data from a porosimeter with a microcomputer. Huang, K.; Su, C.S.; Soong, K.L. (Institute of Nuclear Energy Research, Lung-Tan (Taiwan)). Aug 1984. 39p. (In Chinese). NTIS (US Sales Only), PC A03/MF A01. File Number DE86901032.

By interfacing the digital signal lines of the porosimeter with the microcomputer (the Apple II), pressure values and mercury intrusion depths sent from the porosimeter can be fetched by the computer, data can be selected, calculated and saved in a floppy disk data base, and charts and graphs of the calculation can be printed out with a program written in FORTH. Porosimeter with similar function (not including the disk data base) costs 2 times more than the instrument used in this study.

26792 (INER—0590) Numerical integration and automatic integrator. Wang, C.L. (Institute of Nuclear Energy Research, Lung-Tan (Taiwan)). Aug 1985. 55p. (In Chinese). NTIS (US Sales Only), PC A04/MF A01. File Number DE86901041.

Often in practice on may face the problem of numerical integration and the difficulty in choosing a proper computer program from the library to work out. If one misuses a quadrature routine, the problem may not be solved. This report describes the major methods of numerical integration and introduces some techniques which are often needed in automatic integration programming. Finally, a list of thirty collected quadrature routines is given and a decision tree for selecting a suitable quadrature algorithm is thoroughly discussed. Hopefully, by doing this, it could be some help to prospective users.

26793 (INIS-BR—419, pp 115-152) PLEXUS - A general computer program for fast dynamic analysis. Hoffmann, A.; Lepareux, M.; Schwab, B.; Forestier, A. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette, France. Dept. d'Etudes Mecaniques et Thermiques). 1984. NTIS (US Sales Only), PC A18/MF A01. File Number DE86701405. (CONF-8410303—Vol.3).

From Conference on structural analysis and design of nuclear power plant; Porto Alegre, Brazil (3 Oct 1984).

This paper presents a general description of a computer program PLEXUS (CASTEM) for fast dynamic analysis. In the first part the theoretical aspects are described. In the second part, some applications are given in order to illustrate the possibilities of the program. For mesh generation and visualisation of results the GIBI and ALICE programs (CASTEM) are used.

26794 (K/AIS—5004) Interpreted multiprocess display control system. Heidle, J.M. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 1986. Contract AC05-84OT21400. 11p. (CONF-860470—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE86008844.

From DECUS symposium; Dallas, TX, USA (27 Apr 1986).

Designing a human-interface system for a large data acquisition and process control facility presented many challenges for the software development team. The design goal was to support many classes of users who require simple coordination of multiple devices along with flexible representation and manipulation of real-time data.

26795 (LA—10626-MS) Numerical experiments with CONCHAS-SPRAY: installation of the FLOE algorithm. Cloutman, L.D. (Los Alamos National Lab., NM (USA)). Feb 1986. Contract W-7405-ENG-36. 35p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86007575.

The rezoning phase of the CONCHAS-SPRAY program models the advection terms in the Navier-Stokes equations. Consequently, this code suffers from all the numerical difficulties associated with these terms, except for pure Lagrangian calculations. In particular, the use of any of the available differencing options other than pure donor cell can create artificial oscillations in the solution through the dispersive truncation errors. This report describes the installation of a flux-limiting procedure similar to Chapman's "FRAM" technique that suppresses these oscillations by locally adding enough donor-cell differencing to prevent nonphysical growth of local maxima and minima. 18 refs.

26796 (LA-UR—86-215) Los Alamos tool-oriented software development methodology. Cort, G.; Nelson, R.O. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 11p. (CONF-851264—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE86006025.

From U.S. DECUS symposium; Anaheim, CA, USA (9 Dec 1985).

We present the details of a software development methodology which addresses all phases of the software development life

cycle, yet is well suited for application by small projects with limited resources. The methodology has been developed at the Los Alamos Neutron Scattering Center (LANSCE) and was utilized during the recent development of the LANSCE Data Acquisition Command Language. The methodology employs a comprehensive set of software tools to support development and maintenance of exhaustive documentation for all software components. The impact of the methodology upon software quality and programmer productivity is assessed.

26797 **(LA-UR—86-360) PIC method for modeling the shaped charge problems.** Lee, W.H.; Kwak, D. (Los Alamos National Lab., NM (USA); National Aeronautics and Space Administration, Moffett Field, CA (USA). Ames Research Center). 1986. Contract W-7405-ENG-36. 11p. (CONF-8604114—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE86006039.

From 9. international symposium on ballistics (RMCS); Wiltshire, UK (29 Apr 1986).

The PIC (particle-in-cell) method has been used for computing compressible, multimaterial problems for more than twenty years. The present work extends the same numerical approximation with operator splitting to hydroelastic-plastic flow problems in two-dimensional Eulerian coordinates. Applying the operator splitting method, the basic set of cylindrical equations is split in radial (r) and axial (z) directions. The calculations, performed in each direction separately, are alternated for each time advancement to maintain the accuracy of one-dimensional procedure. A shaped-charge problem is treated using the present code and the results are compared with the experimental data as well as those from other codes. 11 refs.

26798 **(NUREG/CR—4478) UPDATE - a FORTRAN 77 source file manipulator (adapted for the Data General MV series Eclipse computers under AOS/VS).** Kirk, B.L. (Oak Ridge National Lab., TN (USA)). 1986. Contract AC05-84OR21400. 86p. (ORNL/TDMC—4). NTIS, PC A05/MF A01 - GPO. File Number TI86006814.

The primary purpose of UPDATE, which originated at Lawrence Berkeley Laboratory, is to provide a capability for maintaining source files. This portable version, which has the same name and function as the original CDC utility program, serves as a file manager and can be a valuable tool in computer code development work. Written in FORTRAN 77, its general function is to manipulate source files by allowing the user to modify the source code through a series of commands called directives. The source file with UPDATE directives is initially copied to another file called a program library. Changes are then made to the program library. Form this program library is extracted the 'compile-ready' file, that is, the final input to a FORTRAN 77 compiler. 3 refs.

26799 **(ORNL/TM—9922) Communications procedures for the ORNL Solid State Division Interactive Computer System.** Robinson, M.T. (Oak Ridge National Lab., TN (USA)). Mar 1986. Contract AC05-84OR21400. 77p. NTIS, PC A05/MF A01; GPO Dep. File Number DE86009012.

The communications procedures which link the ORNL Solid State Division Interactive Computer System with the central ORNL facilities are described. One set of procedures intercepts 'punch' and 'print' files coming from the central IBM system and routes these to the required destinations. Another set of procedures serves as a submission interface between users and the central facilities. A scheme for automatically supplying passwords in jobs being submitted to the IBM system is included. The security of this scheme is discussed, along with the steps to be used by the Solid State Division system manager to maintain security. An indication is given of changes which may be required in adapting this set of procedures to the needs of other organizations. Listings of the procedures are appended.

26800 **(SAND—85-0844) Semiconductor device modeling on a workstation.** Diegert, C. (Sandia National Labs., Albuquerque, NM (USA)). Sep 1985. Contract AC04-76DP00789. 15p. (CONF-8504207—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE86001125.

From Workshop on large scale computational device modeling; Chicago, IL, USA (18 Apr 1985).

We choose to move from large mainframe computers to workstations to gain the interactive graphics we need to prepare and to analyze semiconductor device modeling problems. Given this much on a workstation, it is convenient to attempt to solve the entire problem there. We find that a top-of-the-line Apollo 660 workstation, with bit-slice processor, pipelined arithmetic processor, and 4 megabytes of real memory, is surprisingly effective in finding solutions when running the Pisces II device modeling code. In our experiment we find where the workstation bogs down when running these problems. We both analyze the Pisces CPU time log and we sample the executing program to accumulate a histogram of execution time as distributed over the source code. Results suggest how Pisces could be adapted to solve somewhat larger problems entirely on the workstation. Evolution of a trusted derivative of Pisces, to be used on supercomputers without interactivity, is suggested to complement our success with Pisces on workstations. 4 refs.

26801 **(TVA/OACD—85/3) Computerized marketing of fruits and vegetables in the Tennessee Valley region: perceptions of growers and buyers.** Brooker, J.R.; Adrian, J.; Free, W.J. (Tennessee Valley Authority, Muscle Shoals, AL (USA). Office of Agricultural and Chemical Development). 1985. 29p. NTIS, PC A03/MF A01. File Number DE86901142.

Computer applications of fruit and vegetable growers in the Tennessee Valley region are limited. Nearly three-fourths of the buyers had never used a computer. The buyers' responses regarding obtaining a computer during the next year were more negative than that of the growers, indicating that these growers are more concerned about their selling problems than the buyers are about their procurement problems. Buyers expressed greater satisfaction with the present marketing system than did the growers, 97 to 63%. (DLC)

26802 **(UCID—20560) Human factors engineering: display development guidelines.** Banks, W.W.; Hunter, S.L.; Noviski, O.J. (Lawrence Livermore National Lab., CA (USA)). Feb 1985. Contract W-7405-ENG-48. 125p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE86006936.

This guide describes how human-factors-engineering design principles are applied to computer-generated display systems. In essence, a human-engineered design considers user needs when pictures are first developed. The human-factors engineer first identifies information to be transferred to the end user. He then selects picture elements and reconciles his design concepts with hardware and software constraints specific to a given installation. The designer is thus encouraged to consider all possible displays without prematurely eliminating choices due to possibly surmountable constraints. This document is for use by two groups of readers. Those desiring an introduction to the design of human-factors-engineered display systems are encouraged to read the entire guide, while those seeking system-specific advice are referred to the appendixes. The Introduction provides an overview of the entire analysis and design process. The importance of this process is emphasized repeatedly, for the designer's ultimate goal is to develop display systems for use by users that match their cognitive and perceptual requirements. By following the process outlined here, system designers are less likely to implement a display system that would require operators to make major changes in their thinking simply to accommodate the system.

26803 **(UCID—20686) Praxis release notes, Versions 7.6 and 7.7.** Holloway, F.W. (Lawrence Livermore National Lab., CA (USA)). 13 Mar 1986. Contract W-7405-ENG-48. 28p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86008786.

Improvements in the Praxis compiler are discussed. Improvements in Version 7.6 include: (1) range checking; (2) traceback on uncaught exceptions; (3) better diagnostics; (4) more run time library support; and (5) error messages to files. Improvements in Version 7.7 include: (1) linking of shareable images; (2) an extensive suite of test/example programs; (3) round, ceiling and floor functions; (4) structure definitions; (5) conversion of real to/from 32

bit integer on PDP; (6) return of a flexible array from a function; and (7) high of variadic parameters. (WRF)

26804 (UIUCDCS-R—86-1188) Polylith architecture. Purtilo, J.M. (Illinois Univ., Urbana (USA). Dept. of Computer Science). Mar 1986. Contract AC02-76ER02383. 56p. (UILU-ENG—86-1708; COO—2383-016). NTIS, PC A04/MF A01; GPO Dep. File Number DE86007640.

Project Polylith is a study of new models for software organization, models that are intended to facilitate a united attack on many software problems of concern today (e.g., rapid prototyping, software re-use or specification of environment.) This report assumes a basic familiarity with the goals and overall spirit of the project and is target for the local audience working on projects utilizing or related to Polylith. It displays more language detail than has previously been available in the literature, and will be most effective when referenced in conjunction with the current configuration files available on project development machines. (WRF)

26805 (UIUCDCS-R—86-1246) Potential for parallelism in ordinary differential equations. Gear, C.W. (Illinois Univ., Urbana (USA). Dept. of Computer Science). Feb 1986. Contract AC02-76ER02383. 19p. (UILU-ENG—86-1705; COO—2383-0115; CONF-860154—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE86007594.

From 2. international conference on computational mathematics; Benin City, Nigeria (1 Jan 1986).

In this paper we are concerned with initial value problems. Techniques for boundary value problems (with the exception of shooting methods) are sufficiently different to those for initial value problems that the parallel techniques and impediments discussed in this paper are inapplicable to boundary value problems.

26806 The effect of restructuring compilers on program performance for high-speed computers. Cytron, R.; Kuck, D.J.; Veidenbaum, A.V. (Dept. of Computer Science, Univ. of Illinois at Urban - Champaign, Urbana, IL 61801). pp 39-48 of Vector and parallel processors in computational science. Duff, I.S.; Reid, J.K. New York, NY; Elsevier (1985). (CONF-8408100—). Contract AC02-81ER10822.

From Conference on vector and parallel processors in computational science II; Oxford, UK (28 Aug 1984).

This paper describes a compiler for transforming serial programs into parallel form, and studies the importance of several transformations. An array machine is selected as the target architecture. A set of programs is compiled and their execution time is measured by simulation. The transformations are evaluated by their effect on the execution time.

26807 Applications of MIMD machines. Buzbee, B.L. (Computing and Communications Div., MSB260, Los Alamos National Lab., Los Alamos, NM 87545). pp 1-5 of Vector and parallel processors in computational science. Duff, I.S.; Reid, J.K. New York, NY; Elsevier (1985). (CONF-8408100—).

From Conference on vector and parallel processors in computational science II; Oxford, UK (28 Aug 1984).

Parallel processing via the application of MIMD machines offers the promise of high performance, and experience with parallel processing is accumulating rapidly. This paper briefly surveys recent results from three classes of MIMD machines - shared memory systems, non-shared memory systems, and a dataflow system. This data confirms that rapid progress is being made in the application of MIMD machines and that parallel processing can yield high performance. It also confirms that major research issues remain to be addressed.

9903 Information Handling

REFER ALSO TO CITATION(S) 25402, 25860, 26310, 26311, 26775

26808 (DOE/OR/21400—T257) Integrated library system at ORNL: LION. Liu, T.C. (Oak Ridge National Lab., TN (USA)). Mar 1986. Contract AC05-84OR21400. 11p. NTIS, PC A02/MF A01; GPO Dep. File Number DE86008867.

Viewgraphs describing the ORNL minicomputer system LION comprise the report. This library system provides information resources and services to support research and development activities. (WRF)

26809 (SAND—85-1941C) Access, control, and release system - ACARS. Sikorski, R.J. (Sandia National Labs., Albuquerque, NM (USA)). 1986. Contract AC04-76DP00789. 27p. (CONF-860260—1). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE86006496.

From Automated Technology Institute conference; Monterey, CA, USA (4 Feb 1986).

The Access, Control, and Release System (ACARS) automates the transfer and control of electronic product definition data between Nuclear Weapons Complex agencies.

26810 (SSDC—35) Guide for the evaluation of displays. Blackman, H.S.; Haney, L.N.; Horman, R.L. (EG and G Idaho, Inc., Idaho Falls (USA). System Safety Development Center). Feb 1986. Contract AC07-76ID01570. 27p. NTIS, PC A03/MF A01; GPO Dep. File Number DE86008179.

This report provides a guide to aid in the evaluation and design of displays and display systems. An analytic or logic tree is used to help designers and evaluators of displays to ensure that display systems are adequate. The tree and other tools are discussed as a means of providing the basic building blocks in doing human factors engineering on display systems. This gives the analyst the tools necessary to evaluate a given task or job and determine the requirements of the accompanying display system. That is, by meticulously following the appropriate branches of the tree, the user is aided in determining that the display provides the appropriate information in the proper format to assure optimal performance by the operator.

26811 (UCRL—53710) Integration of heterogeneous bibliographic information through data abstractions. Breazeal, J.O. (Lawrence Livermore National Lab., CA (USA)). Jan 1986. Contract W-7405-ENG-48. 70p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE86006843.

In this study, heterogeneous bibliographic information resources from geographically distributed locations are integrated in an automated, unified and controlled way by using abstract data types through the Message-Object Model as defined in Smalltalk-80. A unit of modularity call a "class" is developed that defines operations to process the data structures encapsulated in the class. The classes focus on processing bibliographic citations obtained from heterogeneous on-line bibliographic databases into a metaform with the goal of developing information consistency to simplify further information analysis. Classes developed for the bibliographic citation application can speed program development because the data abstractions can be used in processing generic information such as dates regardless of the bibliographic database source. Prototype classes are developed to show the ease in encapsulating data structure and behaviors for the bibliographic citation application. Data abstractions provides a powerful integration technique that allow the designer to work with bibliographic objects without being encumbered with the details of implementation. 21 refs.

9905 Civilian Defense

26812 (AD—224424/2/XAB) Effects of an atomic explosion on group- and family-type shelters. Report for February-May 1955. Vortman, L.J. (Sandia Corp., Albuquerque, NM (USA)). 21 Jan 1957. 192p. NTIS, PC A09/MF A01.

26813 (UCRL—94254) Active defense: a controlled context for arms reduction. Barletta, W.A. (Lawrence Livermore National Lab., CA (USA)). 24 Feb 1986. Contract W-7405-ENG-48. 13p. (CONF-8508154—4). NTIS, PC A02/MF A01; GPO Dep. File Number DE86008386.

From International seminar on nuclear war; Erice, Italy (19 Aug 1985).

The Strategic Defense Initiative (SDI) is described nontechnically, and its place in the current arms control context is considered. Creation of a context for a steady transition from the present

offense-dominated regime of assured destruction to a defense-dominated world of reduced nuclear arsenals is conceived as a progression of small steps to ensure crisis stability at all stages of the transition. The influence of context in the controlled development of active defense is considered. A first agreement in the transition is proposed by the author: that the US and the Soviet Union should agree to forego for ten years the development, testing, and deployment of fast-burn boosters with ranges greater than 1000 nmi. In conjunction with this prohibition, both parties would renounce the testing or deployment in space of interceptors, kinetic or directed energy weapons, for seven years. Research on the scientific and engineering basis of defensive weapons would be encouraged in parallel in both countries, with both parties exchanging scientific information related to defensive boost-phase intercept of ICBM's. (LEW)

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Air Force Ballistic Missile Office, Norton AFB, CA (USA)
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ANG Coal Gasification Co., Beulah, ND (USA)
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The notations in the final parentheses indicate the type of document, e.g., R for Report; the country of publication, e.g., US; and the language if other than English, e.g., In German. Tables of document types and country of publication codes appear after the indexes.

The title may be supplemented with additional words, or a phrase, if it appears additional information would be helpful. In cases for which the title contains little or no information related to the subject entry, it may be replaced entirely by the supplementary information. A qualifier is not always required, and in such cases the title will follow the unqualified subject descriptor.

The descriptors selected for use as subject terms are generally the names of specific materials, things, or processes. To the extent possible, a qualifier is selected to describe the properties of, or processes applied to, the subject term.

Index entries are selected to indicate the important ideas and concepts presented in a document, rather than words that may appear in the text. Within the available thesaurus terms, the most probable or logical place to look for typical information is selected. "See references" are included to guide users from synonymous terms or phrases to the descriptor selected as a subject heading for the concept (e.g., Pipeline Quality Gas, see HIGH BTU GAS). "See also references" are used to indicate where to find references to subject concepts that are narrower, broader, or related to a particular subject heading. To complete an exhaustive search of a given subject, all such headings should be reviewed. Copies of DOE/TIC-7000, the Subject Thesaurus, are available from the National Technical Information Service (NTIS), U.S. Department of Commerce, Springfield, VA 22161.

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AC03-76SF00515	Stanford Linear Accelerator Center, Menlo Park, CA (USA)	
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AC03-81ER40050	California Institute of Technology, Pasadena, California 91125	
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AC03-82CE30746	EIC Labs., Inc., Norwood, MA (USA)	
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AC03-82SF11657	Coastal Carolina Coll., Conway, SC (USA). Carolina Energy Lab.	
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AC03-84ER53158	GA Technologies, San Diego, CA 92138	
	11:26688	IEEE (Institute of Electrical and Electronics Engineers) Transactions on Plasma Science PS
AC04-76DP00613	Allied Corp., Kansas City, MO (USA). Bendix Kansas City Div.	
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AC04-76DP00656	General Electric Co., Largo, FL (USA). Neutron Devices Dept.	
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AC04-76DP00789	Sandia National Labs., Albuquerque, NM (USA)	
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	Lehigh Univ., Bethlehem, PA (USA). Dept. of Mechanical Engineering and Mechanics	
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	Sandia National Labs., Albuquerque, NM (USA)	
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	11:26049	SAND—85-2670
	Air Force Ballistic Missile Office, Norton AFB, CA (USA)	
	11:26127	SAND—85-2086C
	Sandia National Labs., Albuquerque, NM (USA)	
	11:26128	SAND—86-0297C
	National Bureau of Standards, Boulder, CO (USA)	
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	Sandia National Labs., Albuquerque, NM (USA)	
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	11:26384	SAND—85-2501C
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	11:26691	IEEE (Institute of Electrical and Electronics Engineers) Transactions on Plasma Science PS
	11:26740	SAND—85-2754C
	11:26759	SAND—85-1488C
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AC04-76DP03533	**Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant**	
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AC04-76DR00789	**Sandia National Labs., Livermore, CA (USA)**	
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AC04-81AL16338	**Princeton Univ., NJ (USA). Dept. of Mechanical and Aerospace Engineering**	
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AC05-76ER01067	**Department of Physics, Duke University, Durham, North Carolina 27706 and Triangle Universities Nucle**	
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AC05-76OR00033	**Department of Physics, Rutgers University, New Brunswick, New Jersey 08903**	
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AC05-84OR21400	**Oak Ridge National Lab., TN (USA)**	
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	Systems Control, Inc., Palo Alto, CA (USA). Energy Systems Div.	
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	Institute of Gas Technology, Chicago, IL (USA)	
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	11:25770	CONF-8604109—3
	11:25785	ORNL/CON—173
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	Army Toxic and Hazardous Materials Agency, Aberdeen Proving Ground, MD (USA)	
	11:25802	CONF-860394—1
	Oak Ridge National Lab., TN (USA)	
	11:25831	ORNL/TM—9554
	11:25843	DOE/OR/21400—T200
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	11:25849	CONF-860540—1
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	California Univ., Santa Barbara (USA)	
	11:25953	CONF-860560—1
	Oak Ridge National Lab., TN (USA)	
	11:26122	CONF-8506246—1
	11:26155	CONF-860425—8
	11:26157	DOE/OR/21400—T248
	11:26175	ORNL—6196
	11:26176	ORNL—6197
	Martin Marietta Energy Systems, Oak Ridge, TN (USA)	
	11:26281	ORNL/TM—9967/V1
	Oak Ridge National Lab., TN (USA)	
	11:26332	CONF-860146—7
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	Berkeley Hydrotechnique, Inc., CA (USA)	
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	Rensselaer Polytechnic Inst., Troy, NY (USA)	
	11:26681	ORNL/TM—9386
	Oak Ridge National Lab., TN (USA)	
	11:26713	CONF-850814—38
	11:26714	CONF-851102—107
	11:26715	CONF-860324—14
	11:26716	CONF-860324—15
	11:26717	CONF-860421—4
	11:26767	CONF-860584—1
	11:26784	CONF-860568—1
	11:26798	NUREG/CR—4478
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	11:26808	DOE/OR/21400—T257
AC05-84OT21400	**Oak Ridge Gaseous Diffusion Plant, TN (USA)**	
	11:25897	K/PS—1128
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	11:25957	K/D—5697
	Oak Ridge National Lab., TN (USA)	
	11:26124	K/AIS—5005
	Oak Ridge Gaseous Diffusion Plant, TN (USA)	
	11:26794	K/AIS—5004
AC06-76RL01830	**Pacific Northwest Labs., Richland, WA (USA)**	
	11:25291	PNL—5605
	11:25328	PNL-SA—12589
	11:25394	PNL-SA—13356
	11:25431	NUREG/CR—4504
	Battelle Columbus Labs., OH (USA)	
	11:25448	PNL—5798-2
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	Pacific Northwest Labs., Richland, WA (USA)	
	11:25613	NUREG/CR—4436-Vol.1
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	Applied Geomechanics, Inc., Baton Rouge, LA (USA)	
	11:25693	PNL—5519
	Pacific Northwest Labs., Richland, WA (USA)	
	11:25773	DOE/BP/13795—8
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	11:26365	PNL-SA—12528
	11:26368	PNL-SA—13716
	11:26445	PNL-SA—11871
AC07-76GJ01664	**Bendix Field Engineering Corp., Grand Junction, CO (USA)**	
	11:25436	GJ/TMC—12
AC07-76ID01570	**EG and G Idaho, Inc., Idaho Falls (USA)**	
	11:25382	EGG-WM—7152
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	11:25562	EGG-TMI—7108
	Bechtel North American Power Corp., Gaithersburg, MD (USA)	
	11:25565	GEND-INF—073
	EG and G Idaho, Inc., Idaho Falls (USA)	
	11:25671	EGG-TMI—7150
	Idaho National Engineering Lab., Idaho Falls (USA)	
	11:26253	EGG-M—25385
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	EG and G Idaho, Inc., Idaho Falls (USA)	
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	EG and G Idaho, Inc., Idaho Falls (USA). System Safety Development Center	
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	EG and G Idaho, Inc., Idaho Falls (USA). System Safety Development Center	
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	Idaho National Engineering Lab., Idaho Falls (USA)	
	11:26787	EGG-M—31785
	EG and G Idaho, Inc., Idaho Falls (USA). System Safety Development Center	
	11:26810	SSDC—35
AC07-81NE44139	**West Valley Nuclear Services Co., Inc., West Valley, NY (USA)**	
	11:25378	DOE/NE/44139—T2
AC07-82ID12254	**Morrison-Knudsen Engineers, Inc., San Francisco, CA (USA)**	
	11:25459	DOE/ID/12254—1-Vol.4
AC09-76SR00001	**Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.**	
	11:25381	DP-MS—85-104
	11:25435	DPST—83-622-Rev.1
	Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant	
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	Pennsylvania State Univ., University Park (USA). Materials Research Lab.	
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AC11-76PN00014	**Bettis Atomic Power Laboratory, P.O. Box 79, West Mifflin, PA 15122-0079**	
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AC12-76SN00052	**Knolls Atomic Power Lab., Schenectady, NY (USA)**	
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AC18-84PC10621	**Colorado Univ., Boulder (USA). Dept. of Chemical Engineering**	
	11:25286	DOE/FC/10621—2027
AC18-85FC10625	**Georgia Inst. of Tech., Atlanta (USA). School of Applied Biology**	
	11:25446	DOE/FC/10625—2029
AC21-75ET10593	**Western Michigan Univ., Kalamazoo (USA). Dept. of Chemistry**	
	11:25532	DOE/ET/10593—T3
AC21-82MC20229	**Solar Turbines, Inc., San Diego, CA (USA)**	
	11:25298	DOE/MC/20229—T1
AC21-83MC20324	**Westinghouse Electric Corp., Concordville, PA (USA). Combustion Turbine Systems Div.**	
	11:25527	DOE/MC/20324—2033
AC21-84MC21108	**UCC Research Corp., Bristol, VA (USA)**	
	11:25265	DOE/MC/21108—5
AC21-85MC21353	**EG and G/Washington Analytical Services Center, Inc., Morgantown, WV (USA)**	
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AC22-76ET10532	**Chevron Research Co., Richmond, CA (USA)**	
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AC22-79PC20094	**Pittsburgh Univ., PA (USA)**	
	11:26320	DOE/PC/20094—T1
AC22-80ET15614	**Avco-Everett Research Lab., Everett, MA (USA)**	
	11:25742	DOE/ET/15614—22-Pt.1
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AC22-83PC60263	**NUS Corp., Gaithersburg, MD (USA)**	
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AC22-84PC70022	**Union Carbide Corp., South Charleston, WV (USA). Research and Development Dept.**	
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AC22-84PC70815	**TRW Space and Technology Group, Redondo Beach, CA (USA)**	
	11:25317	DOE/PC/70815—T6
AC22-84PC72262	**Schneider Consulting Engineers, Bridgeville, PA (USA)**	
	11:25269	DOE/PC/72262—T1
AI01-76ET20485	**TriSolar Corp., Bedford, MA (USA)**	
	11:25483	DOE/NASA/0310—1
AI01-77CS51040	**Case Western Reserve Univ., Cleveland, OH (USA)**	
	11:25854	DOE/NASA—0563-1
AI01-77CS51042	**Army Mobility Equipment Research and Development Command, Fort Belvoir, VA (USA). Electrical Power Lab.**	
	11:25833	DOE/CS/51042—T8
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AI01-80CS80010	**Tennessee Valley Authority, Muscle Shoals, AL (USA). Office of Agricultural and Chemical Development**	
	11:25453	DOE/CS/80010—T10
AI01-83CE30790	**National Bureau of Standards, Washington, DC (USA). Center for Chemical Physics**	
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AI08-78ET44802	**Geological Survey, Denver, CO (USA)**	
	11:26375	CONF-8509129—3

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AI79-83BP13301	Lambert Engineering, Inc., Bend, OR (USA)	
	11:25772	DOE/BP/13301—2
AS03-76ER72012	California Inst. of Tech., Pasadena (USA)	
	11:25993	DOE/ER/72012—T3
AS05-76ER03992	Center for Particle Theory, The University of Texas at Austin, Austin, Texas 78712	
	11:26503	Physical Review [Section] D: Particles and Fields 33 NO. 7. 1961-1973 (1 Apr 1986).
AS05-76ER04936	Niels Bohr Inst., Copenhagen (Denmark)	
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AS05-76ER05096	T. W. Bonner Laboratories, Physics Department, Rice University, Houston, Texas 77251	
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AS05-76ER05126	Maryland Univ., College Park (USA). Dept. of Physics and Astronomy	
	11:26489	DOE/ER/05126—254
AS05-79ER10407	North Carolina State Univ., Raleigh (USA). Dept. of Physics	
	11:26586	DOE/ER/10407—6
AS05-80ER10714	Physics Department, Tennessee Technological University, Cookeville, Tennessee 38505	
	11:26559	Physical Review [Section] C: Nuclear Physics 33 NO. 4. 1307-1314 (Apr 1986).
AS07-80CS40361	Purdue Univ., Lafayette, IN (USA). Purdue Lab. for Applied Industrial Control	
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AS08-82ER12082	Nevada Univ., Reno (USA). Seismological Lab.	
	11:26379	DOE/ER/12082—1
AT21-81MC16454	West Virginia Univ., Morgantown (USA). Dept. of Mechanical and Aerospace Engineering	
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FC01-79CS40279	Thermo Electron Corp., Waltham, MA (USA). Energy Systems Div.	
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FC02-80CS30329	Mount Airy, City of, NC (USA)	
	11:25492	DOE/CS/30329—T2
FC07-84ID12495	Physical Sciences, Inc., Andover, MA (USA)	
	11:25803	CONF-860540—3
FC21-83FE60181	Hawaii Univ., Honolulu (USA). Dept. of Chemistry	
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	North Dakota Univ., Grand Forks (USA). Energy Research Center	
	11:25297	DOE/FE/60181—2002
	11:25533	DOE/FE/60181—170
FG01-82CE15125	Tung (Shao-E.), Brookline Hill, MA (USA)	
	11:26156	DOE/CE/15125—T1
FG01-82CE15144	Doellner (O.L.), Tucson, AZ (USA)	
	11:25954	DOE/CE/15144—T2
FG01-84EP31046	National Research Council, Washington, DC (USA). Energy Engineering Board	
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FG02-84ER45096	Wisconsin Univ., Madison (USA)	
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FG02-85ER13440	Nebraska Univ., Lincoln (USA). Dept. of Physics and Astronomy	
	11:26440	DOE/ER/13440—T1
FG02-85ER40213	Arizona Univ., Tucson (USA). Dept. of Physics	
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FG02-85ER40235	Illinois Inst. of Tech., Chicago (USA)	
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FG02-85ER45200	Missouri Univ., Columbia (USA). Research Reactor Facility	
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FG02-85ER60297	Colorado State Univ., Fort Collins (USA). Dept. of Fishery and Wildlife Biology	
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FG03-84ER13302	JAYCOR, San Diego, CA (USA)	
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FG05-84ER40149	Florida Univ., Gainesville (USA). Space Astronomy Lab.	
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FG05-84ER45115	North Carolina State Univ., Raleigh (USA). Dept. of Materials Engineering	
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FG05-85ER40215	Oklahoma State Univ., Stillwater (USA). Dept. of Physics	
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FG06-85ER13309	Oregon Univ., Eugene (USA)	
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FG22-81PC40796	Naples Univ. (Italy). Dipartimento di Ingegneria Chimica	
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FG22-82PC50799	Delaware Univ., Newark (USA). Dept. of Chemical Engineering	
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FG22-82PC50808	Princeton Univ., NJ (USA). Dept. of Chemistry	
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FG22-83PC60798	Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Chemical Engineering	
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FG22-83PC60804	Oklahoma Univ., Norman (USA). School of Chemical Engineering and Materials Science	
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FG22-85PC80518	Montana State Univ., Bozeman (USA)	
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FG22-85PC80536	Grambling State Univ., LA (USA)	
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FM02-82FE55014	ANG Coal Gasification Co., Beulah, ND (USA)	
	11:25263	DOE/FE/55014—T17
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RO79-84BP17006	Church/Davis Architects, Portland, OR (USA)	
	11:25774	DOE/BP/17006—1
W-31-109-ENG-38	Argonne National Lab., IL (USA)	
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W-7405-ENG-36	Los Alamos National Lab., NM (USA)	
	11:25360	LA—10472-MS
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052/ 85	NTIS (US Sales Only), PC A04/MF A01		DE86701466	MN -34D	11:26633
053/ 85	NTIS (US Sales Only), PC A02/MF A01		DE86701467	MN -34D	11:26634
055/ 85	NTIS (US Sales Only), PC A02/MF A01		DE86701495	MN -34A	11:25878
056/ 85	NTIS (US Sales Only), PC A03/MF A01		DE86701542	MN -34D	11:26511
CE-Trans-					
8144	NTIS (US Sales Only), PC A02/MF A01; 1		DE86900561	MN -78	11:25561
CEGB-TPRD/B-					
0508/ N84	NTIS (US Sales Only), PC A02/MF A01		DE86701419	MN -77	11:25667
CHES/NAVFAC-FPO-					
1-79(7)	*See* AD-A-163328/8/XAB				11:25490
CNS-					
1165	*See* AD-B-064568/9/XAB				11:25333
COAL-					
8509	*See* PB-86-150380/XAB				11:25290
CONF-650335-	(4. annual power use conference, Portland, OR, USA, 31 Mar-1 Apr 1965)				
	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008036	MN -97	11:26756
CONF-750993-	(3. international conference on ellipsometry, Lincoln, NB, USA, 23-25 Sep 1975)				
4	*See* BNL-37051	E 1.99:	DE86008014	MN -34	11:26437
CONF-7603135-	(4. acrylonitrile licensee meeting, Kaoshung, Taiwan, 9-11 Mar 1976)				
1	NTIS (US Sales Only), PC A03/MF A01; 1		DE86900870	MN -11	11:26289
CONF-761041-	(Workshop on optical fabrication and testing, Tucson, AZ, USA, 18-20 Oct 1976)				
3	*See* BNL-37051	E 1.99:	DE86008014	MN -34	11:26437
CONF-8112119-	(Non-equilibrium statistical processes in nuclear reactions, Osaka, Japan, 3-5 Dec 1981)				
1	*See* RIFP-473		DE86900880	MN -34C	11:26595
CONF-8204204-	(Institute of Nuclear Power Operations conference, Houston, TX, USA, 8 Apr 1982)				
1	*See* UCRL-88131	E 1.99:	DE86008140	MN -41	11:26346
CONF-8210248-	(10. regional congress of International Radiation Protection Association, Avignon, France, 18-22 Oct 1982)				
1	*See* ENEA-RT/STUDI-84-3		DE86900965	MN -41	11:25709
CONF-821160-	(International workshop on bismuth germanate, Princeton, NJ, USA, 10-13 Nov 1982)				
3	*See* TRI-PP-82-44		DE86901071	MN -34	11:26646
CONF-830197-	(Workshop on computer simulation of atomic collision processes in solids, Tokyo, Japan, 27 Jan 1983)				
	See JAERI-M-83-226		DE86780432	MN -34A	11:26610
CONF-830450-	(IAEA/WHO symposium on biological effects of low level radiation, Venice, Italy, 11-15 Apr 1983)				
4	*See* ENEA-RT/STUDI-84-1		DE86900962	MN -41	11:26333
CONF-8305301-	(TRIUMF conference, Vancouver, Canada, 24 May-6 Jun 1983)				
Exc.	*See* TRI-83-2		DE86901063	MN -34D	11:26532
CONF-8306288-	(Acid deposition: environmental, economic, and policy issues, Plattsburgh, NY, USA, 10-12 Jun 1983)				
1	*See* BNL-36875	E 1.99:	DE86007810	MN -11	11:26153
CONF-8309377-	(International conference on nuclear physics, Florence, Italy, 29 Aug-3 Sep 1983)				
1	*See* ENEA-RT/FI-83-10		DE86900996	MN -34C	11:26588
CONF-8310228-	(6. Soviet national conference on neutron physics, Kiev, USSR, 10-14 Oct 1983)				
2	*See* ENEA-RT/FI-83-7		DE86900999	MN -34C	11:26568
3	*See* ENEA-RT/FI-83-9		DE86900997	MN -34C	11:26587
CONF-8310416-	(1. Latin-American Congress and 4. national seminar of nondestructive testing, Sao Paulo, SP, Brazil, 1 Oct 1983)				
3	*See* INIS-BR-438		DE86701622	MN -25	11:25999
4	*See* INIS-BR-439		DE86701623	MN -25	11:26000
5	*See* INIS-BR-440		DE86701624	MN -25	11:26001

Report Number	*Availability Source*	*File Number*	*Distribution Category*	*Abstract Number*
CONF-8311159-	(3. meeting of the advisory group on the comprehensive review and revision of the regulations for the safe transport of radioactive material, Vienna, Austria, 7-11 Nov 1983)			
	See IAEA-AG-406	DE86701445	MN -2	11:25368
CONF-831295-	(6. industrial hygiene convention, Rome, Italy, 5-7 Dec 1983)			
2	*See* ENEA-RT-TIB-84-8	DE86900967	MN -11	11:26290
CONF-840124-	(American Society of Heating, Refrigerating and Air-Conditioning Engineers meeting, Atlanta, GA, USA, 29 Jan-1 Feb 1984)			
	ASHRAE Trans., 90: No. 1B, vp(1984)			11:25501
CONF-8404143-	(10. international conference on cyclotrons and their applications, East Lansing, MI, USA, 30 Apr-3 May 1984)			
	IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854	TI85013505	ND -28	11:26038
CONF-8405378-	(Advisory group on the explanation and application of the agency's transport, Vienna, Austria, 21-25 May 1984)			
	See IAEA-AG-445	DE86701446	MN -2	11:25369
CONF-8406307-	(Summer meeting on sustaining growth in agricultural productivity, Knoxville, TN, USA, 24-27 Jun 1984)			
	St. Joseph, MI; American Society of Agricultural Engineers (1984).			11:25452
	St. Joseph, MI; American Society of Agricultural Engineers (1984).			11:26369
CONF-840805-	(188. meeting of the American Chemical Society, Philadelphia, PA, USA, 26-31 Aug 1984)			
33	*See* TVA/PUB-86/17	DE86901141	MN -4	11:25928
CONF-840914-	(International meeting on thermal nuclear reactor safety, Karlsruhe, F.R. Germany, 10-14 Sep 1984)			
36	*See* CEGB-TPRD/B-0508/N84	DE86701419	MN -77	11:25667
CONF-8409305-	(Conference on experiments on heavy ion beams, Varna, Bulgaria, 13-19 Sep 1984)			
	See JINR-D-7-84-736	DE86780376	MN -37	11:26571
CONF-841007-	(Nuclear science symposium, Orlando, FL, USA, 31 Oct-2 Nov 1984)			
	IEEE Trans. Nucl. Sci., NS-32: No. 1, 82-83(Feb 1985)			11:26118
	IEEE Trans. Nucl. Sci., NS-32: No. 1, 46-49(Feb 1985)			11:26119
	IEEE Trans. Nucl. Sci., NS-32: No. 1, 457-462(Feb 1985)			11:26120
	IEEE Trans. Nucl. Sci., NS-32: No. 1, 419-426(Feb 1985)			11:26121
CONF-8410225-	(9. international symposium on polynuclear aromatic hydcarbons, Columbus, OH, USA, 30 Oct-1 Nov 1984)			
6	*See* PNL-SA-12292	E 1.99: DE86007738	MN -90i	11:25327
CONF-8410309-	(Symposium on the state of physics and mathematics in Africa, Trieste, Italy, 8-16 Oct 1984)			
4	*See* IC-84/185	DE86701463	MN -34D	11:26653
5	*See* IC-85/30	DE86701480	MN -34D	11:26638
CONF-8410397-	(Specialists' meeting on modern gas technologies in housing construction, Frankfurt am Main, F.R. Germany, 24 Oct 1984)			
	NTIS (US Sales Only), PC A06/MF A01; 1	DE86751626	MN -95d	11:25762
CONF-8411145-	(Annual PNWIS/APCA meeting, Portland, OR, USA, 12-14 Nov 1984)			
2	*See* PNL-SA-12528	E 1.99: DE86007715	MN -11	11:26365
CONF-8411237-	(Technical committee and workshop on advanced light and heavy water reactor technology, Vienna, Austria, 26-29 Nov 1984)			
	See IAEA-TECDOC-344	DE86701630	MN -80	11:25545
CONF-8411240-	(Symposium in honor of Professor Gyo Takeda's 60th birthday anniversary, Sendai, Japan, 1 Nov 1984)			
1	*See* LBL-20641	E 1.99: DE86005999	MN -34	11:26643
CONF-841210-	(International chemical congress of Pacific Basin Society, Honolulu, HI, USA, 16-21 Dec 1984)			
31	*See* PNL-SA-12589	E 1.99: DE86007641	MN -90i	11:25328
CONF-850114-	(Joint US/CERN School on Particle Accelerators topical course on non-linear dynamics, Sardinia, Italy, 31 Jan-5 Feb 1985)			
7-Rev.	*See* LBL-18987-Rev.	E 1.99: DE86008376	MN -28	11:26048
CONF-850190-	(Conference on how much does a good environment cost, Stockholm, Sweden, 9 Jan 1985)			
	See IVA-287	DE86751530	MN -11	11:26316
CONF-850254-	(SAE international congress and exhibition, Detroit, MI, USA, 27 Feb-2 Mar 1985)			
3	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE86008177	MN -38	11:25991
4	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE86008175	MN -38	11:25829

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CONF-8502113-	(4. Nordic seminar on radioecology, Gol, Norway, 27 Feb-1 Mar 1985)			
11	*See* INIS-mf-10061	DE86701428	MN -37	11:26101
12	*See* INIS-mf-10046	DE86701434	MN -37	11:26099
13	*See* INIS-mf-10055	DE86701435	MN -37	11:26100
CONF-850301-	(12. annual energy technology conference and exposition, Washington, DC, USA, 25-27 Mar 1985)			
12	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE86007267	MN -62a	11:25694
CONF-8504122-	(11. annual solid waste research symposium, Cincinnati, OH, USA, 29 Apr-1 May 1985)			
Pt.1-Absts.	*See* EPA-600/S9-85-013	TI86901083	MN -11	11:26279
CONF-8504174-	(Energy sources: conservation and renewables, Washington, DC, USA, 27-28 Apr 1985)			
3	*See* LBL-20505	E 1.99: DE86007488	MN -95d	11:25780
CONF-8504207-	(Workshop on large scale computational device modeling, Chicago, IL, USA, 18-19 Apr 1985)			
1	*See* SAND-85-0844	E 1.99: DE86001125	MN -32	11:26800
CONF-850504-	(Particle accelerator conference, Vancouver, Canada, 13-16 May 1985)			
	IEEE Trans. Nucl. Sci., NS-32: No. 5, 3602-3604(Oct 1985)			11:26030
	IEEE Trans. Nucl. Sci., NS-32: No. 5, 3045-3047(Oct 1985)			11:26031
	IEEE Trans. Nucl. Sci., NS-32: No. 5, 2743-2747(Oct 1985)			11:26032
	IEEE Trans. Nucl. Sci., NS-32: No. 5, 2730-2732(Oct 1985)			11:26033
	IEEE Trans. Nucl. Sci., NS-32: No. 5, 3542-3544(Oct 1985)			11:26034
	IEEE Trans. Nucl. Sci., NS-32: No. 5, 3681-3683(Oct 1985)			11:26035
	IEEE Trans. Nucl. Sci., NS-32: No. 5, 3684-3686(Oct 1985)			11:26036
	IEEE Trans. Nucl. Sci., NS-32: No. 5, 3210-3212(Oct 1985)			11:26052
	IEEE Trans. Nucl. Sci., NS-32: No. 5, 3271-3273(Oct 1985)			11:26053
	IEEE Trans. Nucl. Sci., NS-32: No. 5, 2559-2561(Oct 1985)			11:26054
	IEEE Trans. Nucl. Sci., NS-32: No. 5, 3089-3091(Oct 1985)			11:26064
	IEEE Trans. Nucl. Sci., NS-32: No. 5, 3628-3630(Oct 1985)			11:26065
	IEEE Trans. Nucl. Sci., NS-32: No. 5, 3634-3636(Oct 1985)			11:26066
	IEEE Trans. Nucl. Sci., NS-32: No. 5, 3637-3639(Oct 1985)			11:26067
	IEEE Trans. Nucl. Sci., NS-32: No. 5, 3643-3645(Oct 1985)			11:26068
	IEEE Trans. Nucl. Sci., NS-32: No. 5, 3646-3647(Oct 1985)			11:26069
	IEEE Trans. Nucl. Sci., NS-32: No. 5, 3648-3650(Oct 1985)			11:26070
	IEEE Trans. Nucl. Sci., NS-32: No. 5, 3654-3656(Oct 1985)			11:26071
	IEEE Trans. Nucl. Sci., NS-32: No. 5, 3657-3659(Oct 1985)			11:26072
	IEEE Trans. Nucl. Sci., NS-32: No. 5, 3660-3662(Oct 1985)			11:26073
	IEEE Trans. Nucl. Sci., NS-32: No. 5, 3672-3674(Oct 1985)			11:26074
	IEEE Trans. Nucl. Sci., NS-32: No. 5, 3675-3677(Oct 1985)			11:26075
	IEEE Trans. Nucl. Sci., NS-32: No. 5, 3678-3680(Oct 1985)			11:26076
	IEEE Trans. Nucl. Sci., NS-32: No. 5, 3054-3056(Oct 1985)			11:26077
	IEEE Trans. Nucl. Sci., NS-32: No. 5, 3057-3059(Oct 1985)			11:26078
	IEEE Trans. Nucl. Sci., NS-32: No. 5, 3074-3076(Oct 1985)			11:26079
	IEEE Trans. Nucl. Sci., NS-32: No. 5, 3072-3073(Oct 1985)			11:26080
	IEEE Trans. Nucl. Sci., NS-32: No. 5, 3063-3065(Oct 1985)			11:26081
	IEEE Trans. Nucl. Sci., NS-32: No. 5, 3083-3085(Oct 1985)			11:26082
	IEEE Trans. Nucl. Sci., NS-32: No. 5, 3086-3088(Oct 1985)			11:26083
	IEEE Trans. Nucl. Sci., NS-32: No. 5, 3092-3094(Oct 1985)			11:26084
	IEEE Trans. Nucl. Sci., NS-32: No. 5, 3095-3097(Oct 1985)			11:26085

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	IEEE Trans. Nucl. Sci., NS-32: No. 5, 3666-3668(Oct 1985)				11:26087
CONF-850513-	(Symposium on biotechnology for fuels and chemicals, Gatlinburg, TN, USA, 13-17 May 1985)				
5	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008985	MN -70B	11:25377
CONF-8505229-	(New particles conference, Madison, WI, USA, 8-11 May 1985)				
1	*See* RAL-85-072		DE86701532	MN -34D	11:26498
CONF-8505259-	(Seminar on the use of small-scale wind energy plants in developing countries, Goeppingen, F.R. Germany, 14-15 May 1985)				
	See Juel-Spez-328		DE86751624	MN -60	11:25511
CONF-850672-	(2. international conference on nucleus-nucleus collisions, Visby, Sweden, 10-14 Jun 1985)				
13	*See* LBL-20914	E 1.99:	DE86007422	MN -34C	11:26547
CONF-8506100-	(3. IEEE conference on human factors and power plants, Monterey, CA, USA, 23-27 Jun 1985)				
8	*See* RISO-M-2520		DE86701411	MN -80	11:25659
CONF-8506194-	(International symposium on multiparticle dynamics, Kiryat Anavim, Israel, 9-14 Jun 1985)				
9	*See* DESY-85-107		DE86751096	MN -34D	11:26488
CONF-8506238-	(Seminar on risk: decisions, concepts, and measures, Oslo, Norway, 17-19 Jun 1985)				
1	*See* RISO-M-2518		DE86701409	MN -80	11:25688
CONF-8506246-	(American Society of Heating, Refrigerating, and Air-Conditioning Engineers symposium on advances in heat activated machines, Portland, OR, USA, 22-25 Jun 1985)				
1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE86006074	MN -37	11:26122
CONF-850734-	(2. international synchrotron radiation instrumentation conference, Stanford, CA, USA, 29 Jul-2 Aug 1985)				
22	*See* BNL-37707	E 1.99:	DE86008012	MN -28	11:26056
23	*See* LBL-20135	E 1.99:	DE86008374	MN -37	11:26125
CONF-850768-	(SLAC summer institute on particle physics, Stanford, CA, USA, 23 Jul-3 Aug 1985)				
9	*See* LBL-20492	E 1.99:	DE86008398	MN -34D	11:26496
CONF-850774-	(International conference on hot electrons, Innsbruck, Austria, 8-12 Jul 1985)				
Absts.	*See* INIS-mf-10073		DE86701485	MN -34A	11:26622
CONF-8507113-	(32. Sagamore army materials research conference, Lake Luzerne, NY, USA, 22-26 Jul 1985)				
1	*See* UCRL-92640	E 1.99:	DE86008766	MN -38	11:26002
CONF-850814-	(Cryogenic engineering conference and international cryogenic materials conference, Boston, MA, USA, 12-16 Aug 1985)				
38	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86008977	MN -20	11:26713
CONF-8508120-	(Kyoto international symposium: the jubilee of the meson theory, Kyoto, Japan, 15-17 Aug 1985)				
5	*See* DESY-85-104		DE86751097	MN -34D	11:26487
CONF-8508154-	(International seminar on nuclear war, Erice, Italy, 19-24 Aug 1985)				
4	*See* UCRL-94254	E 1.99:	DE86008386	MN -2	11:26813
CONF-850914-	(Phase space approach to nuclear dynamics meeting, Miramare, Trieste, Italy, 30 Sep-4 Oct 1985)				
1	*See* GSI-85-55-Prepr.		DE86751102	MN -34C	11:26589
CONF-850917-	(Topical meeting on criticality safety and the storage of fissile material, Jackson, WY, USA, 9-12 Sep 1985)				
7	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008974	MN -78	11:25668
CONF-850918-	(International topical meeting on high level nuclear waste disposal - technology and engineering, Pasco, WA, USA, 24-26 Sep 1985)				
10	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86008975	MN -70	11:26382
CONF-850920-	(9. international conference on magnet technology, Zurich, Switzerland, 9-13 Sep 1985)				
11	*See* TRI-PP-85-79		DE86900762	MN -28	11:26051
CONF-850942-	(190. American Chemical Society national meeting, Chicago, IL, USA, 8-13 Sep 1985)				
53	*See* TRI-PP-85-112		DE86901017	MN -28	11:26062
CONF-850953-	(3. symposium on containment of underground nuclear explosions, Idaho Falls, ID, USA, 10-12 Sep 1985)				
22	*See* UCRL-92456	E 1.99:	DE86008387	MN -45	11:26144
Vol.2	NTIS, PC A19/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008380	MN -45	11:26142
CONF-8509129-	(International symposium on fundamentals of rock joints, Bjorkliden, Lapland, Sweden, 15-20 Sep 1985)				
3	CENTEK Publishers, Postadress: S-951 87 Lulea, Sweden		TI86008341	ND -70	11:26375
CONF-8509150-	(NATO advanced study institute on laser surface treatment of metals, San Miniato, Italy, 2-13 Sep 1985)				
3	*See* RISO-M-2519		DE86701410	MN -80	11:25658
CONF-8509213-	(Frontiers of quantum Monte Carlo conference, Los Alamos, NM, USA, 3-6 Sep 1985)				
6	*See* BNL-37779	E 1.99:	DE86008006	MN -34D	11:26483

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CONF-8509254-	(ARGOS users conference, New Orleans, LA, USA, 23 Sep 1985)			
1	*See* SAND-86-0221C	E 1.99: DE86007144	MN -11	11:26247
CONF-8509257-	(NATO workshop on fundamental aspects of quantum theory, Como, Italy, 2-7 Sep 1985)			
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE86007510	MN -34A	11:26635
2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE86007509	MN -34A	11:26636
CONF-8509260-	(Workshop on feasibility of solar neutrino detection with /sup 205/T1 by geochemical and accelerator mass spectroscopical methods, Munich, F.R. Germany, 22-24 Sep 1985)			
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE86007478	MN -34B	11:26551
CONF-851009-	(IEEE nuclear science symposium, San Francisco, CA, USA, 23-25 Oct 1985)			
66	*See* TRI-PP-85-91	DE86901015	MN -37	11:26114
CONF-851010-	(Symposium on nuclear power systems, San Francisco, CA, USA, 23-25 Oct 1985)			
	IEEE Trans. Nucl. Sci., NS-33: No. 1, vp(Feb 1986)			11:25444
CONF-851050-	(International symposium on whole-plant physiology: coupling of carbon, water, and nutrient interactions in woody plant soil systems, Knoxville, TN, USA, 6-11 Oct 1985)			
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE86007919	MN -11	11:26349
CONF-851052-	(17. annual symposium on optical materials for high-power lasers, Boulder, CO, USA, 28-30 Oct 1985)			
5	*See* SAND-85-2076C	E 1.99: DE86008776	MN -25	11:25881
CONF-8510103-	(Automotive technology development contractors' coordination meeting, Dearborn, MI, USA, 20-25 Oct 1985)			
7	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE86008982	MN -96	11:25851
CONF-8510115-	(American Concrete Institute fall meeting on polymers in concrete, Chicago, IL, USA, 3-4 Oct 1985)			
1-Rev.	*See* BNL-36465-Rev.	E 1.99: DE86008392	MN -25	11:25884
CONF-8510151-	(28. Oak Ridge National Laboratory conference on analytical chemistry, Knoxville, TN, USA, 1-3 Oct 1985)			
17	*See* K/PS-5063	E 1.99: DE86008897	MN -22	11:25925
CONF-8510160-	(ASM metals congress/TMS-AIME fall meeting, Toronto, Ontario, Canada, 13-18 Oct 1985)			
15	*See* PNL-SA-13135	E 1.99: DE86007727	MN -25	11:25861
CONF-8510186-	(International conference on insertion devices, Stanford, CA, USA, 28-30 Oct 1985)			
11	*See* LBL-20581	E 1.99: DE86008372	MN -28	11:26061
CONF-8510218-	(Field data acquisition for building and equipment energy-use monitoring national workshop, Dallas, TX, USA, 16 Oct 1985)			
	NTIS, PC A13/MF A01; 1 (GPO Dep.)	E 1.99: DE86008569	MN -95d	11:25769
CONF-8510235-	(Workplace aerosol monitoring workshop, Napa, CA, USA, 28-30 Oct 1985)			
4	*See* EGG-M-25585	TI86007661	MN -41	11:26254
5	*See* EGG-M-25385	E 1.99: DE86007663	MN -41	11:26253
CONF-8510254-	(Chapman conference on magnetotail physics, Laurel, MD, USA, 28-31 Oct 1985)			
5	*See* LA-UR-86-961	E 1.99: DE86008742	MN -34B	11:26430
CONF-8510263-	(Workshop on the design of a low energy antimatter facility, Madison, WI, USA, 3-5 Oct 1985)			
2	*See* LA-UR-86-820	E 1.99: DE86008725	MN -34D	11:26474
CONF-8510290-	(9. meeting of the Gesellschaft fuer Umwelt-Mutationsforschung e.V.: somatic mutations and cancer, Neuherberg, F.R. Germany, 16-18 Oct 1985)			
Abstr.	*See* GSF-37/85	DE86751457	MN -48	11:26351
CONF-851102-	(11. symposium on engineering problems in fusion research, Austin, TX, USA, 18-22 Nov 1985)			
107	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE86008979	MN -20a	11:26714
CONF-851128-	(17. European conference on laser interaction with matter, Rome, Italy, 18-22 Nov 1985)			
1	*See* LA-UR-86-503	E 1.99: DE86007385	MN -21	11:26730
CONF-851185-	(International laser science conference, Dallas, TX, USA, 18-22 Nov 1985)			
2-Rev.1	*See* UCRL-93471-Rev.1	E 1.99: DE86008144	MN -34A	11:26448
16	*See* SAND-86-0013C	E 1.99: DE86007820	MN -34	11:26447
CONF-851208-	(8. international conference on lasers, Las Vegas, NV, USA, 2-6 Dec 1985)			
3	*See* LA-UR-86-770	E 1.99: DE86007368	MN -37	11:25981
4	*See* LBL-20065	E 1.99: DE86008378	MN -34	11:26443
CONF-851217-	(Materials Research Society meeting, Boston, MA, USA, 2-7 Dec 1985)			
59	*See* DP-MS-85-158	E 1.99: DE86008046	MN -70	11:25896
CONF-851264-	(U.S. DECUS symposium, Anaheim, CA, USA, 9-13 Dec 1985)			
1	*See* LA-UR-86-215	E 1.99: DE86006025	MN -32	11:26796
CONF-851274-	(National wind energy conference, Noordwijkerhout, Netherlands, 1 Dec 1985)			
1	*See* THE-R-759-D		ND -60	11:25525

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2	*See* THD-IW-R-508		ND -60	11:25524
CONF-860114-	(American Society for Testing and Materials Committee C-26 meeting on nuclear fuel cycle, New Orleans, LA, USA, 13-17 Jan 1986)			
2	*See* LA-UR-86-889	E 1.99: DE86008730	MN -4	11:25920
CONF-860130-	(24. AIAA aerospace science meeting, Reno, NV, USA, 6-9 Jan 1986)			
4	*See* SAND-85-1520C	TI86005884	ND -38	11:25994
CONF-860144-	(Workshop on atomic physics with stored cooled heavy ion beams, Oak Ridge, TN, USA, 13-15 Jan 1986)			
1	*See* BNL-37595	DE86007805	MN -34A	11:26055
CONF-860146-	(Radiobioassay and internal dosimetry workshop, Albuquerque, NM, USA, 20 Jan 1986)			
6	*See* PNL-SA-13663	E 1.99: DE86007736	MN -41	11:26344
7	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE86007854	MN -41	11:26332
CONF-860147-	(Conference on new techniques and ideas in quantum measurement theory, New York City, NY, USA, 21-24 Jan 1986)			
2	*See* LBL-21046	E 1.99: DE86008373	MN -34D	11:26644
CONF-860149-	(DOE beta measurement workshop, Albuquerque, NM, USA, 23-24 Jan 1986)			
2	*See* RFP-3935	DE86007964	MN -41	11:26345
CONF-860152-	(10. annual conference on composites and advanced ceramic materials, Cocoa Beach, FL, USA, 19-24 Jan 1986)			
2	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE86008539	MN -25	11:25885
CONF-860154-	(2. international conference on computational mathematics, Benin City, Nigeria, 1 Jan 1986)			
1	*See* UIUCDCS-R-86-1246	E 1.99: DE86007594	MN -32	11:26805
CONF-860158-	(25. international meeting on nuclear physics, Bormio, Italy, 20-25 Jan 1986)			
1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE86007867	MN -34C	11:26582
CONF-860160-	(14. international workshop on the gross properties of nuclei and nuclear excitation, Hirschegg, Austria, 13-18 Jan 1986)			
1	*See* LBL-20859	E 1.99: DE86008375	MN -34B	11:26412
CONF-860164-	(Conference on spatio-temporal coherence and chaos in physical systems, Los Alamos, NM, USA, 21-24 Jan 1986)			
1	*See* UCRL-94304	E 1.99: DE86008382	MN -34	11:26466
2	*See* UCRL-94283	E 1.99: DE86008770	MN -34	11:26465
CONF-860210-	(IEEE Power Engineering Society winter meeting, New York, NY, USA, 2-7 Feb 1986)			
3	*See* PNL-SA-13716	E 1.99: DE86007734	MN -11	11:26368
CONF-860213-	(6. symposium on the transfer and utilization of particulate control technology, New Orleans, LA, USA, 25-28 Feb 1986)			
1	*See* DOE/FE/60181-170	E 1.99: DE86008813	MN -90	11:25533
CONF-860214-	(Workshop on environmental and human risks of tritium, Karlsruhe, F.R. Germany, 17-19 Feb 1986)			
1	*See* DP-MS-86-3	E 1.99: DE86007160	MN -11	11:26278
CONF-860254-	(Northwest Council on Computer Education conference, Seattle, WA, USA, 6-8 Feb 1986)			
1	*See* UCRL-93954	E 1.99: DE86006297	MN -32	11:26761
CONF-860260-	(Automated Technology Institute conference, Monterey, CA, USA, 4-6 Feb 1986)			
1	*See* SAND-85-1941C	E 1.99: DE86006496	MN -32	11:26809
CONF-860270-	(4. winter workshop on nuclear dynamics, Copper Mountain, CO, USA, 24-28 Feb 1986)			
2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE86008241	MN -34C	11:26575
3	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE86008238	MN -34C	11:26583
CONF-860304-	(Corrosion '86, Houston, TX, USA, 17-21 Mar 1986)			
6	*See* DP-MS-85-2	E 1.99: DE86008907	MN -25	11:25855
CONF-860316-	(Topical meeting on short wavelength coherent radiation, Monterey, CA, USA, 24-27 Mar 1986)			
1	*See* SAND-85-2692C	E 1.99: DE86008775	MN -34A	11:26446
2	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE86008883	MN -20	11:26656
CONF-860317-	(Waste management '86, Tucson, AZ, USA, 2-6 Mar 1986)			
28	*See* PNL-SA-13356	E 1.99: DE86007732	MN -70	11:25394
36	*See* DP-MS-85-104	E 1.99: DE86008906	MN -70	11:25381
CONF-860324-	(High temperature plasma diagnostics, Hilton Head Island, SC, USA, 9-13 Mar 1986)			
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE86007856	MN -20	11:26657
13	*See* LA-UR-86-848	E 1.99: DE86008729	MN -20f	11:26680
14	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE86008506	MN -20	11:26715
15	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE86008503	MN -20	11:26716
17	*See* LA-UR-86-867	E 1.99: DE86008720	MN -20f	11:26732
18	*See* LA-UR-86-869	E 1.99: DE86008722	MN -20f	11:26734
19	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE86008886	MN -20	11:26658
20	*See* LA-UR-86-866	E 1.99: DE86008719	MN -20f	11:26731
21	*See* LA-UR-86-868	E 1.99: DE86008721	MN -20f	11:26733

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CONF-860330-	(5. annual target fabrication specialists meeting, Las Vegas, NV, USA, 24-27 Mar 1986)			
2	*See* SAND-85-2754C	E 1.99: DE86008773	MN -21	11:26740
CONF-860359-	(Eastern simulation conference, Norfolk, VA, USA, 10-12 Mar 1986)			
1	*See* UCRL-93773	E 1.99: DE86005090	MN -32	11:25623
CONF-860365-	(Propulsion systems hazard meeting, Monterey, CA, USA, 6-7 Mar 1986)			
1	*See* LA-UR-86-378	E 1.99: DE86006040	MN -45	11:26135
CONF-860366-	(SPIE technical symposium on applications of artificial intelligence, Orlando, FL, USA, 31 Mar 1986)			
3	*See* LA-UR-86-1027	E 1.99: DE86008751	MN -38	11:25963
CONF-860383-	(Norman D. Watson symposium on environmental impact of volcanism, Kingston, RI, USA, 12-14 Mar 1986)			
1	*See* SAND-86-0449C	E 1.99: DE86007708	MN -11	11:26248
CONF-860384-	(Conference on measurement of electrical quantities in pulse power systems-II, Gaithersburg, MD, USA, 5-7 Mar 1986)			
6	*See* SAND-86-0498C	E 1.99: DE86007831	MN -37	11:26129
CONF-860394-	(Air pollution control association international speciality conference on technical issues and problems of hazardous waste permitting, Orlando, FL, USA, 2-5 Mar 1986)			
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE86008224	MN -95e	11:25802
CONF-860396-	(Symposium on the many facets of heavy ion fusion reactions, Argonne, IL, USA, 24-26 Mar 1986)			
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE86008530	MN -34C	11:26584
2	*See* UCRL-94313	E 1.99: DE86008759	MN -34C	11:26596
CONF-860397-	(March forum of the SSSC and CAMS of the National Research Council, Washington, DC, USA, 10-14 Mar 1986)			
1	*See* SAND-86-0297C	E 1.99: DE86008403	MN -37	11:26128
CONF-860405-	(10. annual symposium on energy from biomass and wastes, Washington, DC, USA, 7-10 Apr 1986)			
1	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99: DE86008541	MN -61A	11:25462
2	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE86009154	MN -61B	11:25463
CONF-860412-	(13. European conference on controlled fusion and plasma heating, Schliersee, F.R. Germany, 14-18 Apr 1986)			
1	*See* UCRL-93946	E 1.99: DE86008762	MN -20a	11:26743
CONF-860418-	(88. annual meeting of the American Ceramic Society, Chicago, IL, USA, 27 Apr-1 May 1986)			
2	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE86008498	MN -70	11:25894
CONF-860421-	(2. international conference on fusion reactor materials (ICFRM-2), Chicago, IL, USA, 13-17 Apr 1986)			
4	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE86008531	MN -20c	11:26717
6	*See* UCRL-93492	E 1.99: DE86008771	MN -20c	11:25862
7	*See* LA-UR-86-983	E 1.99: DE86008746	MN -28	11:26060
8	*See* LA-UR-86-1048	E 1.99: DE86008753	MN -20c	11:25859
9	*See* LA-UR-86-1005	E 1.99: DE86008750	MN -20c	11:26738
10	*See* UCRL-93513	E 1.99: DE86008761	MN -20c	11:26742
11	*See* UCRL-93493	E 1.99: DE86008769	MN -20c	11:25882
12	*See* DOE/ER/10107-31	E 1.99: DE86009048	MN -20c	11:25852
16	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE86009153	MN -20c	11:25847
18	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE86009156	MN -20c	11:25848
CONF-860425-	(191. American Chemical Society national meeting, New York, NY, USA, 13-18 Apr 1986)			
8	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE86004760	MN -41	11:26155
10	*See* BNL-37346	E 1.99: DE86005255	MN -11	11:26154
12	*See* LBL-20591	E 1.99: DE86005980	MN -11	11:26174
21	*See* DOE/FE/60181-168	E 1.99: DE86008812	MN -90a	11:25287
CONF-860434-	(IEEE international conference on robotics and automation, San Francisco, CA, USA, 14-17 Apr 1986)			
2	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE86001333	MN -38	11:25951
5	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE86006089	MN -38	11:25952
CONF-860442-	(General meeting of the American Physical Society, Washington, DC, USA, 28 Apr-1 May 1986)			
1	*See* DOE/ER/40159-098	DE86007340	MN -34C	11:26570
CONF-860470-	(DECUS symposium, Dallas, TX, USA, 27 Apr-2 May 1986)			
2	*See* K/AIS-5004	E 1.99: DE86008844	MN -32	11:26794
CONF-860479-	(18. Southeast symposium on system theory, Knoxville, TN, USA, 7-8 Apr 1986)			
2	*See* K/AIS-5005	E 1.99: DE86005491	MN -37	11:26124
CONF-860495-	(International conference on metallurgical coatings, San Diego, CA, USA, 7-11 Apr 1986)			
2	*See* LA-UR-86-1061	E 1.99: DE86008755	MN -25	11:26624
CONF-8604109-	(Pacific Gas and Electric (PG&E) energy expo, Oakland, CA, USA, 1 Apr 1986)			
3	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE86008504	MN -95	11:25770

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CONF-8604110-	(Program specification and transformation IFIP TC2 working conference, Bad Toelz, F.R. Germany, 14-17 Apr 1986)			
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE86005555	MN -32	11:26785
CONF-8604114-	(9. international symposium on ballistics (RMCS), Wiltshire, UK, 29 Apr-1 May 1986)			
1	*See* LA-UR-86-360	E 1.99: DE86006039	MN -32	11:26797
CONF-8604115-	(3. flight testing conference, Las Vegas, NV, USA, 2-4 Apr 1986)			
1	*See* SAND-85-2086C	E 1.99: DE86006234	MN -37	11:26127
CONF-8604147-	(3. symposium on electromagnetic launch technology, Austin, TX, USA, 20-22 Apr 1986)			
1	*See* LA-UR-86-861	E 1.99: DE86008718	MN -38	11:25958
2	*See* LA-UR-86-941	E 1.99: DE86008738	MN -38	11:25959
3	*See* LA-UR-86-943	E 1.99: DE86008740	MN -38	11:25961
5	*See* LA-UR-86-922	E 1.99: DE86008733	MN -20	11:26735
6	*See* LA-UR-86-925	E 1.99: DE86008734	MN -20	11:26736
7	*See* LA-UR-86-942	E 1.99: DE86008739	MN -38	11:25960
8	*See* LA-UR-86-926	E 1.99: DE86008735	MN -20	11:26737
CONF-8604148-	(Ideas in science and electronics conference, Albuquerque, NM, USA, 29 Apr-1 May 1986)			
1	*See* SAND-86-0528C	E 1.99: DE86007616	MN -38	11:25967
2	*See* LA-UR-86-991	E 1.99: DE86008747	MN -38	11:25962
CONF-8604150-	(American Institute for Design and Drafting convention, Hollywood, FL, USA, 7-10 Apr 1986)			
1	*See* K/D-5697	E 1.99: DE86008926	MN -38	11:25957
CONF-860501-	(Conference on the science and technology of fast reactor safety, Channel Islands, UK, 12-16 May 1986)			
1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85014990	MN -79p	11:25669
2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE86005474	MN -79p	11:25670
CONF-860504-	(5. international conference on fluidization, Elsinore, Denmark, 18-23 May 1986)			
1	I.G.T., 3424 South State St., Chicago, IL 60616	TI86900896	MN -90c	11:26016
CONF-860517-	(4. fluid mechanics, plasma dynamics and laser conference, Atlanta, GA, USA, 12-14 May 1986)			
1	*See* SAND-85-2324C	E 1.99: DE86005171	MN -38	11:25995
2	*See* UCRL-93615	E 1.99: DE86005774	MN -38	11:25996
CONF-860519-	(Carnahan conference on security, Lexington, KY, USA, 14-16 May 1986)			
3	*See* SAND-85-2059	E 1.99: DE86006259	MN -15	11:25441
4	*See* SAND-85-2236	E 1.99: DE86006462	MN -15	11:25443
CONF-860530-	(9. international symposium on chemical reaction engineering, Philadelphia, PA, USA, 18-21 May 1986)			
1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE86001256	MN -90	11:25992
2	*See* LA-UR-85-3936	E 1.99: DE86003683	MN -4	11:25932
CONF-860531-	(Annual meeting of the Association of American Geographers, Minneapolis, MN, USA, 4-7 May 1986)			
1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE86002243	MN -95a	11:25761
CONF-860540-	(169. meeting of the Electrochemical Society, Boston, MA, USA, 4-9 May 1986)			
1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE86004803	MN -93A	11:25849
2	*See* SAND-85-1728C	E 1.99: DE86003583	MN -25	11:26005
3	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE86004636	MN -93A	11:25803
CONF-860560-	(20. aerospace mechanism symposium, Cleveland, OH, USA, 7-9 May 1986)			
1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE86004780	MN -86	11:25953
CONF-860562-	(6. conference on atmospheric radiation, Williamsburg, VA, USA, 12-16 May 1986)			
1	*See* UCRL-93488	E 1.99: DE86006531	MN -34B	11:26148
CONF-860563-	(40. annual quality congress, Anaheim, CA, USA, 19-21 May 1986)			
1	*See* UCRL-94031	E 1.99: DE86006681	MN -70	11:25396
CONF-860564-	(EMP nuclear meeting, Albuquerque, NM, USA, 19-24 May 1986)			
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE86003858	MN -97a	11:25541
CONF-860566-	(Electronic components conference, Seattle, WA, USA, 5-7 May 1986)			
1	*See* SAND-85-2420C	E 1.99: DE86006494	MN -38	11:26007
2	*See* SAND-85-2505C	E 1.99: DE86007705	MN -70	11:25395
CONF-860567-	(SPE unconventional gas technology symposium, Louisville, KY, USA, 18-21 May 1986)			
1	*See* SAND-85-2501C	E 1.99: DE86007149	MN -92a	11:26384
2	*See* SAND-85-2502C	E 1.99: DE86007703	MN -92a	11:25352
3	*See* SAND-85-2507C	E 1.99: DE86007618	MN -92a	11:25359
4	*See* SAND-85-2506C	E 1.99: DE86008338	MN -92a	11:25358
CONF-860568-	(National Computer Graphics Association meeting, Anaheim, CA, USA, 11-15 May 1986)			
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE86007327	MN -32	11:26784
2	*See* EGG-M-31785	E 1.99: DE86007646	MN -32	11:26787
CONF-860581-	(33. international technical communication conference, Detroit, MI, USA, 11-14 May 1986)			
1	*See* LA-UR-86-784	E 1.99: DE86007366	MN -13	11:26758
2	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE86007523	MN -13	11:26757

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CONF-860584-	(American Society for Information Science's mid-year meeting, Portland, OR, USA, 11-14 May 1986)				
1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86007565	MN -13	11:26767
CONF-860585-	(International conference on computational mechanics, Tokyo, Japan, 25-29 May 1986)				
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86007475	MN -25	11:25895
2	NTIS, PC A02/MF A01 - GPO		TI86007868	MN -78	11:25850
CONF-860586-	(World conference on continuing education, Lake Buena Vista, FL, USA, 7-9 May 1986)				
1	*See* SAND-85-1488C	E 1.99:	DE86007706	MN -13	11:26759
CONF-860589-	(Institute for Electrical and Electronics Engineers international conference on circuits and systems, San Jose, CA, USA, 5-7 May 1986)				
1	*See* UCRL-94153	E 1.99:	DE86008018	MN -38	11:26380
CONF-860727-	(Computers in engineering conference, Chicago, IL, USA, 20 Jul 1986)				
2	*See* UCRL-94028		DE86008691	MN -71	11:25371
COO-					
2383-016	*See* UIUCDCS-R-86-1188	E 1.99:	DE86007640	MN -32	11:26804
2383-0115	*See* UIUCDCS-R-86-1246	E 1.99:	DE86007594	MN -32	11:26805
CRDC-SP-					
86001	*See* AD-A-163086/2/XAB				11:26764
CSIR/SR/HOUT-					
337	*See* PB-86-151107/XAB				11:25817
341	*See* PB-86-146503/XAB				11:25816
CSSA-ASTRO-					
85-20	*See* AD-A-163091/2/XAB				11:26404
85-24	*See* AD-A-163104/3/XAB				11:26406
85-25	*See* AD-A-163090/4/XAB				11:26629
85-26-REV	*See* AD-A-163105/0/XAB				11:26407
CT-					
149-31	*See* PB-86-133766/XAB				11:26201
CTA-IEAV-NT-					
03/ 85	NTIS (US Sales Only), PC A02/MF A01		DE86701640	MN -32	11:26599
05/ 85	NTIS (US Sales Only), PC A06/MF A01		DE86701625	MN -80	11:25620
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001/ 83	NTIS (US Sales Only), PC A02/MF A01		DE86701499	MN -20	11:26659
002/ 83	NTIS (US Sales Only), PC A02/MF A01		DE86701503	MN -20	11:26660
CTH-JVG-					
17	NTIS (US Sales Only), PC A03/MF A01; 1		DE86751526	MN -94a	11:25695
DESY-					
85-099	NTIS (US Sales Only), PC A02/MF A01		DE86751098	MN -34D	11:26485
85-100	NTIS (US Sales Only), PC A02/MF A01		DE86751095	MN -34D	11:26469
85-102	NTIS (US Sales Only), PC A02/MF A01		DE86751094	MN -34D	11:26486
85-104	NTIS (US Sales Only), PC A02/MF A01		DE86751097	MN -34D	11:26487
85-106	NTIS (US Sales Only), PC A02/MF A01		DE86751125	MN -34D	11:26527
85-107	NTIS (US Sales Only), PC A02/MF A01		DE86751096	MN -34D	11:26488
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85-49	NTIS (US Sales Only), PC A07/MF A01; 1		DE86751461	MN -48	11:26350
DOE/BP-					
584	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008827	MN -95	11:25771
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2	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008822	MN -95d	11:25772
DOE/BP/13795-					
8	NTIS, PC A05/MF A01 (GPO Dep.)	E 1.99:	DE86008370	MN -95d	11:25773
DOE/BP/17006-					
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DOE/BPA-					
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DOE/CE-					
0145	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008484	MN -95	11:25776
DOE/CE/15125-					
T1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE86005676	MN -90i	11:26156
DOE/CE/15144-					
T2	NTIS, PC A06/MF A01; 1 (GPO Dep.)	E 1.99:	DE86007289	MN -37	11:25954
DOE/CE/30746-					
5	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008330	STD -59B	11:25777
DOE/CE/30790-					
T1	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008686	MN -95e	11:25820
DOE/CE/40685-					
T1	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008553	STD -95f	11:25804
DOE/CE/50070-					
T10	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86009062	MN -96	11:25842
DOE/CS/30259-					
T2	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008260	MN -59B	11:25491
DOE/CS/30329-					
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DOE/CS/40279-					
T1	NTIS, PC A10/MF A01; 1 (GPO Dep.)	E 1.99:	DE86005627	STD -95f	11:25805
DOE/CS/40361-					
T31-Vol.1	NTIS, PC A22/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008994	MN -95f	11:25806
T31-Vol.2	NTIS, PC A19/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008995	MN -95f	11:25807
T31-Vol.3	NTIS, PC A14/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008996	MN -95f	11:25808

Report Number	Availability Source	File Number		Distribution Category	Abstract Number
DOE/CS/51042-					
T8	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008277	MN -96	11:25833
T11	NTIS, PC A04/MF A01; 1		DE86008280	MN -96	11:25834
DOE/CS/80010-					
T10	NTIS, PC A07/MF A01; 1 (GPO Dep.)	E 1.99:	DE86009064	MN -61D	11:25453
DOE/DP-					
0001/ 17	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE86007209	STD -16	11:25438
DOE/EIA-					
022(86/ 01)	NTIS, PC A03/MF A01 - GPO (GPO Dep.)	E 1.99:	DE86009118	MN -98E	11:25731
0035(85/ 12)	NTIS, PC A07/MF A01; 1 - GPO (GPO Dep.)	E 1.99:	DE86008509	MN -98	11:25726
0109(85/ 12)	NTIS, PC A05/MF A01; 1 - GPO (GPO Dep.)	E 1.99:	DE86007120	MN -98B	11:25336
0109(86/ 01)	NTIS, PC A07/MF A01; 1 - GPO (GPO Dep.)	E 1.99:	DE86008556	MN -98B	11:25337
0149(85)	NTIS, PC A06/MF A01; 1 - GPO (GPO Dep.)	E 1.99:	DE86008417	MN -98	11:25723
0173(85)	NTIS, PC A04/MF A01; 1 - GPO (GPO Dep.)	E 1.99:	DE86007943	MN -98	11:25705
0204(86/ 01)	NTIS, PC A03/MF A01; 1 - GPO (GPO Dep.)	E 1.99:	DE86008207	MN -98	11:25713
0292(85)	NTIS, PC A08/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008899	MN -98G	11:25714
0376(83)	NTIS, PC A13/MF A01 - GPO (GPO Dep.)	E 1.99:	DE86007107	MN -98	11:25706
0380(85/ 12)	NTIS, PC A08/MF A01; 1 - GPO (GPO Dep.)	E 1.99:	DE86007683	MN -98B	11:25338
0380(86/ 01)	NTIS, PC A08/MF A01; 1 - GPO (GPO Dep.)	E 1.99:	DE86008908	MN -98B	11:25339
0483	NTIS, PC A04/MF A01; 1 - GPO (GPO Dep.)	E 1.99:	DE86008814	MN -98A	11:25322
0484(85)	NTIS, PC A04/MF A01; 1 - GPO (GPO Dep.)	E 1.99:	DE86008208	MN -98	11:25340
0485	NTIS, PC A07/MF A01; 1 - GPO (GPO Dep.)	E 1.99:	DE86008419	MN -98	11:25719
0486	NTIS, PC A03/MF A01 - GPO (GPO Dep.)	E 1.99:	DE86008898	MN -98B	11:25341
DOE/EIS-					
0063	NTIS, PC A10/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008214	MN -70	11:25429
0095F	*See* PNL-SA-12528	E 1.99:	DE86007715	MN -11	11:26365
0109F	NTIS, PC A23/MF A01 (GPO Dep.)	E 1.99:	DE86008418	STD -70A	11:26276
0126-D-Vol.1	NTIS, PC A12/MF A01; 1 (GPO Dep.)	E 1.99:	DE86009138	MN -70A	11:26277
DOE/EP/31046-					
T1	NTIS, PC A07/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008551	MN -98B	11:25342
DOE/ER-					
0261	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008702	MN -91	11:25361
DOE/ER/01167-					
48	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86007184	MN -34C	11:25942
DOE/ER/01428-					
519	NTIS, PC A07/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008869	MN -34D	11:26470
520	NTIS, PC A10/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008868	MN -34D	11:26471
521	NTIS, PC A07/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008871	MN -34D	11:26472
522	NTIS, PC A07/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008870	MN -34D	11:26473
DOE/ER/05126-					
254	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE86007349	MN -34D	11:26489
DOE/ER/10107-					
31	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE86009048	MN -20c	11:25852
DOE/ER/10397-					
4	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86007655	MN -34C	11:26585
DOE/ER/10407-					
6	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86008420	MN -34D	11:26586
DOE/ER/12072-					
T1	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE86007433	MN -63	11:25464
DOE/ER/12082-					
1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE86007976	MN -11	11:26379
DOE/ER/12095-					
T1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86009055	MN -61E	11:26319
DOE/ER/13160-					
2	NTIS, PC A03; 3		DE86008527	MN -48	11:26330
3	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE86008528	MN -48	11:26328
DOE/ER/13302-					
T1	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE86006838	MN -20b	11:26718
DOE/ER/13309-					
2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008052	MN -38	11:25978
DOE/ER/13440-					
T1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86008360	MN -34	11:26440
DOE/ER/40025-					
T3	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86007020	MN -37	11:26090
DOE/ER/40121-					
6	NTIS, PC A06/MF A01; 1 (GPO Dep.)	E 1.99:	DE86007414	MN -37	11:25955
DOE/ER/40149-					
1(2)	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE86004399	MN -34C	11:26091
DOE/ER/40159-					
098	NTIS, PC A02; 3		DE86007340	MN -34C	11:26570
DOE/ER/40213-					
1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86008388	MN -34D	11:26528
DOE/ER/40215-					
T1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE86009008	MN -34D	11:26512
T2	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE86009006	MN -34D	11:26513
T3	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE86009007	MN -34D	11:26637
DOE/ER/40235-					
1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86008865	MN -34D	11:26490
DOE/ER/45096-					
T1	NTIS, PC A02; 3		DE86008836	MN -25	11:25853
DOE/ER/45115-					
2	NTIS MF A01; 2 (GPO Dep.)	E 1.99:	DE86008211	MN -25	11:25845
DOE/ER/45200-					
2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86007007	MN -37	11:26576

Report Number	Availability Source	File Number		Distribution Category	Abstract Number
DOE/ER/60138-T4	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE86006150	MN -32	11:26786
DOE/ER/60297-2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008966	MN -48	11:26265
DOE/ER/72012-T3	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86008369	MN -38	11:25993
DOE/ET/10532-T30	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86004223	MN -90d	11:25285
DOE/ET/10593-T3	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE86007468	MN -90e	11:25532
DOE/ET/10815-113	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008924	MN -90g	11:25741
DOE/ET/15614-22-Pt.1	NTIS, PC A19/MF A01; 1 (GPO Dep.)	E 1.99:	DE86007357	STD -90g	11:25742
22-Pt.2	NTIS, PC A20/MF A01; 1 (GPO Dep.)	E 1.99:	DE86007358	STD -90g	11:25743
22-Pt.3	NTIS, PC A14/MF A01; 1 (GPO Dep.)	E 1.99:	DE86007359	STD -90g	11:25744
DOE/FC/10621-2027	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86008200	MN -90a	11:25286
DOE/FC/10625-2029	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86008842	MN -90a	11:25446
DOE/FE/55014-T16	NTIS, PC A11/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008805	MN -90c	11:25306
T17	NTIS, PC A08/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008801	MN -90c	11:25263
T18	NTIS, PC A09/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008802	MN -90c	11:25264
T19	NTIS, PC A17/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008806	MN -90c	11:25307
DOE/FE/60181-168	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86008812	MN -90a	11:25287
170	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008813	MN -90	11:25533
2002	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008840	STD -90c	11:25297
DOE/ID/12254-1-Vol.4	NTIS, PC A10/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008333	MN -97e	11:25459
DOE/MC/16454-T13	NTIS PC A04/MF A01		DE84001860	MN -90i	11:25879
T14	NTIS, PC A12/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008040	MN -90i	11:26147
DOE/MC/20229-T1	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE86007918	MN -90i	11:25298
DOE/MC/20324-2033	NTIS, PC A16/MF A01; 1 (GPO Dep.)	E 1.99:	DE86007171	STD -93	11:25527
DOE/MC/21108-5	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86006896	MN -90i	11:25265
DOE/MC/21353-2005	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86001064	MN -92	11:25351
DOE/METC-85/ 4014	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE86001019	MN -90c	11:25266
85/ 4054	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE86001042	MN -92a	11:25356
86/ 4057	NTIS, PC A06/MF A01; 1 (GPO Dep.)	E 1.99:	DE86001061	MN -90c	11:25267
DOE/NASA-0563-1	NTIS, PC A02/MF A01		TI86008577	STD -25	11:25854
DOE/NASA/0310-1	NTIS, PC A09/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008611	MN -63	11:25483
DOE/NBM-6007218	NTIS, PC A06/MF A01; 1 (GPO Dep.)	E 1.99:	DE86007218	MN -41	11:25534
6008055	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86008055	MN -98	11:25724
DOE/NE/44139-T2	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE86007744	STD -70	11:25378
DOE/OR/21400-T200	NTIS, PC A02/MF A01; 1		DE86002256	MN -96	11:25843
T248	NTIS, PC A06/MF A01; 1 (GPO Dep.)	E 1.99:	DE86007855	MN -41	11:26157
T257	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86008867	MN -32	11:26808
DOE/PC/20094-T1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008303	MN -48	11:26320
DOE/PC/40796-T1	NTIS, PC A07/MF A01; 1 (GPO Dep.)	E 1.99:	DE86006155	STD -90c	11:25315
DOE/PC/50799-T9	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008357	MN -90d	11:25268
DOE/PC/50808-T10	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008679	MN -90a	11:25316
DOE/PC/60263-1	NTIS, PC A09/MF A01; 1 (GPO Dep.)	E 1.99:	DE86006282	STD -90i	11:26158
DOE/PC/60804-T10	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86008784	MN -90d	11:25288
DOE/PC/70022-T1	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008350	MN -92	11:25454
DOE/PC/70815-T6	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008331	MN -90e	11:25317
DOE/PC/72262-T1	NTIS, PC A09/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008254	STD -90d	11:25269
DOE/PC/80518-T2	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86008598	MN -90a	11:25924
DOE/PC/80536-T2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008783	MN -90a	11:25447
DOE/PE/70404-H1	NTIS, PC A15/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008845	MN -95	11:25721

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DOE/RW-					
0004/ 2	NTIS, PC A04/MF A01 (GPO Dep.)	E 1.99:	DE86008485	STD -70	11:25379
0030	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86008109	MN -70	11:25380
DOE/S-					
0047	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE86007551	MN -2	11:25715
DOE/SF/11657-					
T1	Coastal Carolina College/Univ. of S. Carolina Energy Lab., Conway, S.C. 29526		TI86008550	ND -95d	11:25778
DP-MS-					
85-2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008907	MN -25	11:25855
85-104	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86008906	MN -70	11:25381
85-158	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008046	MN -70	11:25896
86-3	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE86007160	MN -11	11:26278
DPST-					
83-319-Rev.1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008041	MN -11	11:26315
83-622-Rev.1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008043	MN -11	11:25435
86-274	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008905	MN -4	11:25931
DTH-ABK-R-					
200	Krarup (N.), Copenhagen (Denmark)			ND -60	11:25510
DTH-EI-LHT-					
117	NTIS (US Sales Only), PC A02/MF A01; 1		DE86751518	MN -63	11:25465
DTH-LV-					
170	NTIS (US Sales Only), PC A02/MF A01; 1		DE86751512	MN -59A	11:25493
DTH-LV-MEDD-					
169	NTIS (US Sales Only), PC A04/MF A01; 1		DE86751511	MN -62	11:25498
EEB-					
85-7	*See* LBL-20505	E 1.99:	DE86007488	MN -95d	11:25780
EFN-					
17	NTIS (US Sales Only), PC A06/MF A01; 1		DE86751528	MN -97	11:25732
EFN-LET-					
1985-31	NTIS (US Sales Only), PC A04/MF A01; 1		DE86751529	MN -64	11:25502
EGG-					
2445	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE86008319	STD -66a	11:25500
EGG-M-					
25385	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86007663	MN -41	11:26253
25585	NTIS, PC A02/MF A01 - GPO		TI86007661	MN -41	11:26254
31785	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86007646	MN -32	11:26787
EGG-SSDC-					
7A	NTIS, PC A06/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008178	MN -41	11:26370
31	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE86008183	MN -41	11:26768
EGG-TMI-					
7108	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86007652	MN -78	11:25562
7150	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE86009091	MN -78	11:25671
EGG-WM-					
7152	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86009094	MN -70	11:25382
EIR-					
539	NTIS (US Sales Only), PC A05/MF A01		DE86701449	MN -32	11:26788
553	NTIS (US Sales Only), PC A05/MF A01		DE86701418	MN -78	11:25672
557	NTIS (US Sales Only), PC A04/MF A01; 1		DE86751630	MN -94d	11:25809
ENEA-RT-COMB-					
84-3	NTIS (US Sales Only), PC A02/MF A01		DE86701439	MN -70	11:25383
84-7	NTIS (US Sales Only), PC A03/MF A01		DE86701639	MN -70	11:25384
84-9	NTIS (US Sales Only), PC A03/MF A01		DE86701629	MN -80	11:25640
ENEA-RT-DISP-					
83-2	NTIS (US Sales Only), PC A06/MF A01		DE86701406	MN -80	11:25673
83-5	NTIS (US Sales Only), PC A05/MF A01		DE86701407	MN -80	11:25674
ENEA-RT/FI-					
83-5	NTIS (US Sales Only), PC A03/MF A01; 1		DE86901000	MN -32	11:26789
83-7	NTIS (US Sales Only), PC A02/MF A01		DE86900999	MN -34C	11:26568
83-9	NTIS (US Sales Only), PC A02/MF A01		DE86900997	MN -34C	11:26587
83-10	NTIS (US Sales Only), PC A02/MF A01; 1		DE86900996	MN -34C	11:26588
ENEA-RT-FUS-					
84-3	NTIS (US Sales Only), PC A02/MF A01		DE86701501	MN -20	11:26661
84-13	NTIS (US Sales Only), PC A02/MF A01		DE86701517	MN -20	11:26662
84-14	NTIS (US Sales Only), PC A02/MF A01		DE86701500	MN -20	11:26663
ENEA-RT/STUDI-					
84-1	NTIS (US Sales Only), PC A02/MF A01; 1		DE86900962	MN -41	11:26333
84-3	NTIS (US Sales Only), PC A02/MF A01; 1		DE86900965	MN -41	11:25709
ENEA-RT-TERM-					
84-3	NTIS (US Sales Only), PC A04/MF A01		DE86701415	MN -78	11:25563
ENEA-RT-TIB-					
84-8	NTIS (US Sales Only), PC A02/MF A01; 1		DE86900967	MN -11	11:26290
84-25	NTIS (US Sales Only), PC A05/MF A01		DE86701549	MN -46	11:26600
84-36	NTIS (US Sales Only), PC A02/MF A01		DE86701498	MN -34A	11:26441
84-37	NTIS (US Sales Only), PC A03/MF A01		DE86701504	MN -20	11:25979
84-39	NTIS (US Sales Only), PC A02/MF A01		DE86701505	MN -20	11:25980
ENEA-RT-VEL-					
84-4	NTIS (US Sales Only), PC A02/MF A01		DE86701422	MN -79	11:25601
84-7	NTIS (US Sales Only), PC A04/MF A01		DE86701423	MN -79	11:25602
EPA-					
450/ 3-85-013	NTIS, PC A04/ MF A01		TI86900480	MN -11	11:26256
450/ 3-85-019a	NTIS, PC A12/MF A01		TI86900578	MN -11	11:26257
600/ S9-85-013	NTIS, PC A02/MF A01		TI86901083	MN -11	11:26279

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EPA/440/1-				
85/ 055	*See* PB-86-114949/XAB			11:25346
EPA/450/2-				
85/ 006	*See* PB-86-137403/XAB			11:26261
85/ 007	*See* PB-86-139599/XAB			11:26225
EPA/450/3-				
82/ 005B	*See* PB-86-145083/XAB			11:26238
85/ 013	*See* PB-86-147899/XAB			11:26264
85/ 024	*See* PB-86-126448/XAB			11:26179
85/ 026	*See* PB-86-136504/XAB			11:26210
EPA/520/5-				
85/ 030	*See* PB-86-141959/XAB			11:26314
EPA/530/SW-				
85/ 024	*See* PB-86-125580/XAB			11:26273
EPA/600/2-				
85/ 130	*See* PB-86-128022/XAB			11:26299
EPA/600/3-				
86/ 002	*See* PB-86-144870/XAB			11:26237
EPA/910/9-				
85/ 138	*See* PB-86-143880/XAB			11:26263
EPA/AA/IMG-				
85/ 6	*See* PB-86-143872/XAB			11:25840
EPA/AA/SDSB-				
85/ 5	*See* PB-86-141785/XAB			11:25838
EPA/IMSD-				
85/ 002	*See* PB-86-139375/XAB			11:26224
EPRI-AP-				
4464	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI86920217	ND -63	11:25466
4466	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI86920226	ND -63	11:25484
4472	Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303	TI86920227	ND -90b	11:25270
4475	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI86920230	ND -97d	11:25528
4476	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI86920228	ND -93	11:25529
4491	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI86920229	ND -90h	11:25318
EPRI-CS-				
4384-Vol.1	Research Reports Center, Box 50490 Palo Alto, CA 94303	TI86920197	ND -90i	11:25299
4384-Vol.2	Research Reports Center, Box 50490 Palo Alto, CA 94303	TI86007950	ND -90i	11:25810
4384-Vol.3	Research Reports Center, Box 50490 Palo Alto, CA 94303	TI86920198	ND -90i	11:25811
4419-Vol.1	Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303	TI86920207	ND -90i	11:25812
4442	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI86920233	ND -90e	11:25300
4446	Research Reports Centers, Box 50490, Palo Alto, CA 94303	TI86920196	ND -90i	11:25813
EPRI-EA-				
3417-Vol.3	NTIS, PC A13/MF A01; 1 - Research Reports Center, Box 50490, Palo Alto, CA 94303 (GPO Dep.)	E 1.99: DE86008997	MN -90i	11:26280
EPRI-EL-				
4503	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI86920225	ND -97a	11:25945
EPRI-NP-				
4306-SR	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI86920221	ND -78	11:25675
4456	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI86920220	ND -78	11:25632
4470M	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI86920202	ND -78	11:25544
4512	Research Reports Center, Box 50490, Palo Alto, CA 94303	TI86920222	ND -78	11:25564
ERLN-				
605	*See* PB-86-111564/XAB			11:26323
FAA-EE-				
85-4	*See* AD-A-163232/2/XAB			11:26152
FE-				
2018-21	*See* DOE/ET/10593-T3	E 1.99: DE86007468	MN -90e	11:25532
2315-122	*See* DOE/ET/10532-T30	E 1.99: DE86004223	MN -90d	11:25285
FES-				
83-23	NTIS, PC A16/MF A01; 1 (GPO Dep.)	E 1.99: DE86008552	MN -11	11:25535
FNAL-TM-				
1383	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE86008120	STD -28	11:26043
1384	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE86009136	STD -28	11:26092
1385	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE86008123	STD -28	11:26044
1386	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE86008124	STD -28	11:26093
1388	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE86008122	STD -28	11:26045
1389	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE86009135	STD -28	11:26046
1390	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE86009137	STD -28	11:26057

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FNAL/Trans-353	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99: DE86007089	MN -28	11:26088
FSGTR-FPL-45	*See* PB-86-144490/XAB			11:25456
FSRB-NE-87	*See* PB-86-144946/XAB			11:25470
FSRN-SO-314	*See* PB-86-121399/XAB			11:25469
GA-A-17851	*See* EIR-539	DE86701449	MN -32	11:26788
GAO/NSIAD-85-91	General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760	TI86900609	MN -69	11:25727
GAO/RCED-85-129	General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760	TI86900599	MN -11	11:26258
85-151	US General Accounting Office, Document Handlings and Information. Services Facility, P.O. Box 6015, Gaithersburg, MD 20760	TI86900592	MN -98B	11:25343
86-12	General Accounting Office, Box 6015, Gaithersburg, MD 20877	TI86901167	MN -92	11:25355
86-27	General Accounting Office, Box 6015, Gaithersburg, MD 20877	TI86901166	MN -78	11:25612
86-36	General Accounting Office, Box 6015, Gaithersburg, MD 20877	TI86901165	MN -90c	11:25271
86-84	General Accounting Office, Box 6015, Gaithersburg, MD 20877	TI86901168	MN -92	11:25350
GCA-TR-CH-84-04	*See* PB-86-134020/XAB			11:26204
GEND-INF-073	NTIS, PC A09/MF A01; 1 (GPO Dep.)	E 1.99: DE86009068	MN -78	11:25565
GEPP-TIS-892	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE86008791	MN -13	11:25745
GJ/TMC-12	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99: DE86008794	STD -70A	11:25436
GKSS-85/ E/ 30	NTIS (US Sales Only), PC A09/MF A01	DE86751101	MN -11	11:26291
GL-3756	*See* AD-A-163106/8/XAB			11:25972
GRS-A-1078	*See* EIR-553	DE86701418	MN -78	11:25672
GSF-16/ 85	NTIS (US Sales Only), PC A04/MF A01; 1	DE86751459	MN -69	11:26015
25/ 85	NTIS (US Sales Only), PC A03/MF A01	DE86751108	MN -41	11:26334
37/ 85	NTIS (US Sales Only), PC A03/MF A01	DE86751457	MN -48	11:26351
GSF-OE-846	*See* GSF-16/85	DE86751459	MN -69	11:26015
GSI-85-18	NTIS (US Sales Only), PC A03/MF A01	DE86751091	MN -28	11:26047
85-22	NTIS (US Sales Only), PC A06/MF A01	DE86751115	MN -34C	11:26578
85-54-Prepr.	NTIS (US Sales Only), PC A03/MF A01	DE86751100	MN -37	11:26094
85-55-Prepr.	NTIS (US Sales Only), PC A02/MF A01	DE86751102	MN -34C	11:26589
HETA-80-007-1520	*See* PB-86-133741/XAB			11:26199
80-073-1589	*See* PB-86-138278/XAB			11:26220
81-369-1591	*See* PB-86-133758/XAB			11:26200
82-289-1496	*See* PB-86-141231/XAB			11:26227
83-044-1596	*See* PB-86-133691/XAB			11:26194
83-107-1574	*See* PB-86-133725/XAB			11:26197
83-376-1556	*See* PB-86-133683/XAB			11:26193
84-004-1568	*See* PB-86-129483/XAB			11:26181
84-026-1599	*See* PB-86-137890/XAB			11:26218
84-041-1592	*See* PB-86-135449/XAB			11:26206
84-046-1584	*See* PB-86-133709/XAB			11:26195
84-050-1595	*See* PB-86-136710/XAB			11:26214
84-151-1544	*See* PB-86-138724/XAB			11:26222
84-172-1573	*See* PB-86-133717/XAB			11:26196
84-228-1582	*See* PB-86-133733/XAB			11:26198
84-239-1586	*See* PB-86-136645/XAB			11:26212
84-307-1581	*See* PB-86-132792/XAB			11:26190
84-321-1590	*See* PB-86-133774/XAB			11:26202
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84-404-1579	*See* PB-86-141876/XAB			11:26230
84-513-1572	*See* PB-86-141249/XAB			11:26228
85-020-1587	*See* PB-86-132172/XAB			11:26188
85-065-1578	*See* PB-86-141256/XAB			11:26229
85-100-1585	*See* PB-86-132180/XAB			11:26189
85-108-1593	*See* PB-86-132164/XAB			11:26187
85-132-1598	*See* PB-86-135431/XAB			11:26205
HHS/PUB/FDA-86-8253	*See* PB-86-140944/XAB			11:26326

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IA-				
1396	NTIS (US Sales Only), PC A03/MF A01; 1	DE86901081	MN -21	11:26719
IAEA-AG-				
406	NTIS (US Sales Only), PC A07/MF A01	DE86701445	MN -2	11:25368
445	NTIS (US Sales Only), PC A08/MF A01	DE86701446	MN -2	11:25369
IAEA-SM-				
266/ 77	*See* ENEA-RT/STUDI-84-1	DE86900962	MN -41	11:26333
IAEA-TECDOC-				
344	NTIS (US Sales Only), PC A10/MF A01	DE86701630	MN -80	11:25545
354	NTIS (US Sales Only), PC A03/MF A01	DE86701447	MN -2	11:25370
IC-				
84/ 113	NTIS (US Sales Only), PC A02/MF A01	DE86701392	MN -38	11:25956
84/ 177	NTIS (US Sales Only), PC A02/MF A01	DE86701462	MN -34D	11:26652
84/ 185	NTIS (US Sales Only), PC A02/MF A01	DE86701463	MN -34D	11:26653
84/ 224	NTIS (US Sales Only), PC A02/MF A01	DE86701443	MN -2	11:25716
85/ 30	NTIS (US Sales Only), PC A02/MF A01	DE86701480	MN -34D	11:26638
IEAL-R-				
85-70	*See* NUREG/CR-4446	TI86900890	MN -2	11:25614
IFE/KR/E-				
85/ 005	NTIS (US Sales Only), PC A04/MF A01	DE86701386	MN -41	11:25536
85/ 007	NTIS (US Sales Only), PC A02/MF A01	DE86701444	MN -2	11:25720
IFRF-F-				
038/ a/ 4	IFRF, P.O. Box 10000, 1970 CA IJmuiden, Netherlands		ND -90e	11:25319
IFT-P-				
10/ 85	NTIS (US Sales Only), PC A02/MF A01	DE86701468	MN -34D	11:26639
IITRI-C-				
06472	*See* PB-86-142163/XAB			11:26233
IITRI-E-				
06549-20	*See* AD-A-162900/5/XAB			11:26366
ILE-				
8410P	NTIS (US Sales Only), PC A02/MF A01	DE86701512	MN -20	11:26664
INDC(CPR)-				
006/ L	NTIS (US Sales Only), PC A02/MF A01	DE86701551	MN -46	11:26601
INDC(JPN)-				
105/ L	*See* NEANDC(J)-119/U	TI86901088	ND -34C	11:26572
INER-				
0530	NTIS (US Sales Only), PC A02/MF A01; 1	DE86901028	MN -32	11:26790
0553	NTIS (US Sales Only), PC A03/MF A01; 1	DE86901032	MN -32	11:26791
0560	NTIS (US Sales Only), PC A04/MF A01; 1	DE86901033	MN -34A	11:26442
0586	NTIS (US Sales Only), PC A03/MF A01; 1	DE86901040	MN -78	11:25641
0590	NTIS (US Sales Only), PC A04/MF A01; 1	DE86901041	MN -32	11:26792
INFN/AE-				
82-10	NTIS (US Sales Only), PC A02/MF A01	DE86701634	MN -37	11:26095
85-3	NTIS (US Sales Only), PC A02/MF A01	DE86701527	MN -34B	11:26411
85-4	NTIS (US Sales Only), PC A02/MF A01	DE86701471	MN -34D	11:26640
INFN/BE-				
84-10	NTIS (US Sales Only), PC A02/MF A01; 1	DE86900961	MN -34C	11:26552
INFN/TC-				
85-6	NTIS (US Sales Only), PC A02/MF A01	DE86701635	MN -37	11:26096
85-9	NTIS (US Sales Only), PC A02/MF A01	DE86701636	MN -37	11:26097
INIS-BR-				
425	NTIS (US Sales Only), PC A02/MF A01	DE86701496	MN -34A	11:26621
426	NTIS (US Sales Only), PC A04/MF A01	DE86701481	MN -34D	11:26641
427	NTIS (US Sales Only), PC A06/MF A01	DE86701633	MN -37	11:26098
428	NTIS (US Sales Only), PC A07/MF A01	DE86701631	MN -78	11:25572
438	NTIS (US Sales Only), PC A02/MF A01	DE86701622	MN -25	11:25999
439	NTIS (US Sales Only), PC A02/MF A01	DE86701623	MN -25	11:26000
440	NTIS (US Sales Only), PC A02/MF A01	DE86701624	MN -25	11:26001
INIS-mf-				
9862	NTIS (US Sales Only), PC A10/MF A01	DE86751111	MN -20a	11:26665
9863	NTIS (US Sales Only), PC A09/MF A01	DE86751093	MN -34D	11:26491
9864	NTIS (US Sales Only), PC A04/MF A01	DE86751092	MN -34C	11:26577
9866	NTIS (US Sales Only), PC A02/MF A01	DE86751099	MN -34D	11:26642
10046	NTIS (US Sales Only), PC A02/MF A01	DE86701434	MN -37	11:26099
10055	NTIS (US Sales Only), PC A02/MF A01	DE86701435	MN -37	11:26100
10061	NTIS (US Sales Only), PC A02/MF A01	DE86701428	MN -37	11:26101
10069	NTIS (US Sales Only), PC A02/MF A01	DE86701628	MN -80	11:25638
10073	NTIS (US Sales Only), PC A07/MF A01	DE86701485	MN -34A	11:26622
10074	NTIS (US Sales Only), PC A02/MF A01	DE86701475	MN -34D	11:26529
10082	NTIS (US Sales Only), PC A04/MF A01	DE86701643	MN -2	11:26544
10083	NTIS (US Sales Only), PC A08/MF A01	DE86701647	MN -2	11:26058
INS-				
503	NTIS (US Sales Only), PC A02/MF A01	DE86701555	MN -34C	11:26562
504	NTIS (US Sales Only), PC A02/MF A01	DE86701482	MN -34D	11:26514
506	NTIS (US Sales Only), PC A02/MF A01	DE86701536	MN -34D	11:26492
507	NTIS (US Sales Only), PC A02/MF A01	DE86701537	MN -34D	11:26493
508	NTIS (US Sales Only), PC A02/MF A01	DE86701531	MN -34D	11:26494
509	NTIS (US Sales Only), PC A02/MF A01	DE86701538	MN -34D	11:26495
510	NTIS (US Sales Only), PC A02/MF A01	DE86701543	MN -34D	11:26515
511	NTIS (US Sales Only), PC A02/MF A01	DE86701544	MN -34D	11:26516
512	NTIS (US Sales Only), PC A02/MF A01	DE86701556	MN -34C	11:26590
516	NTIS (US Sales Only), PC A03/MF A01	DE86701553	MN -34C	11:26591

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IP-UT-TNP-Rep-					
1	NTIS (US Sales Only), PC A02/MF A01		DE86900866	MN -34	11:26592
IPP-					
6/ 250	NTIS (US Sales Only), PC A05/MF A01		DE86751124	MN -20f	11:26666
6/ 252	NTIS (US Sales Only), PC A03/MF A01		DE86751117	MN -20f	11:26667
6/ 253	NTIS (US Sales Only), PC A03/MF A01		DE86751120	MN -20a	11:26720
6/ 255	NTIS (US Sales Only), PC A04/MF A01		DE86751123	MN -20g	11:26668
III/ 103	NTIS (US Sales Only), PC A03/MF A01		DE86751118	MN -20a	11:26669
III/ 106	NTIS (US Sales Only), PC A02/MF A01		DE86751119	MN -20a	11:26670
IPPJ-					
670	NTIS (US Sales Only), PC A07/MF A01		DE86701515	MN -20	11:26671
696	NTIS (US Sales Only), PC A02/MF A01		DE86701508	MN -20	11:26672
698	NTIS (US Sales Only), PC A02/MF A01		DE86701516	MN -20	11:26673
IPPJ-DT-					
112	NTIS (US Sales Only), PC A03/MF A01		DE86701519	MN -20	11:26721
113	NTIS (US Sales Only), PC A03/MF A01		DE86701506	MN -20	11:26674
IQI-R-					
85-0710	*See* AD-A-162567/2/XAB				11:25998
ISPO-					
216	*See* LA-10615-M	E 1.99:	DE86008574	STD -15	11:25439
ITOP-					
4-2-602	*See* AD-A-162532/6/XAB				11:26762
IVA-					
287	NTIS (US Sales Only), PC A05/MF A01; 1		DE86751530	MN -11	11:26316
IWGFR-					
51	NTIS (US Sales Only), PC A09/MF A01		DE86701424	MN -79	11:25610
IWS-					
67.31	*See* PB-86-135613/XAB				11:26207
67.35	*See* PB-86-135621/XAB				11:26208
67.46	*See* PB-86-133105/XAB				11:26192
74.46	*See* PB-86-138286/XAB				11:26221
JAERI-M-					
83-226	NTIS (US Sales Only), PC A06/MF A01		DE86780432	MN -34A	11:26610
84-168	NTIS (US Sales Only), PC A12/MF A01		DE86701425	MN -80	11:25662
84-179	NTIS (US Sales Only), PC A04/MF A01		DE86701420	MN -77	11:25585
84-201	NTIS (US Sales Only), PC A03/MF A01		DE86701421	MN -77	11:25586
84-202	NTIS (US Sales Only), PC A06/MF A01		DE86701417	MN -78	11:25558
84-225	NTIS (US Sales Only), PC A05/MF A01		DE86701518	MN -20	11:26675
85-005	NTIS (US Sales Only), PC A02/MF A01		DE86701514	MN -20	11:26676
85-006	NTIS (US Sales Only), PC A11/MF A01		DE86701502	MN -20	11:26722
85-007	NTIS (US Sales Only), PC A03/MF A01		DE86701521	MN -20	11:26723
85-009	NTIS (US Sales Only), PC A04/MF A01		DE86701522	MN -20	11:26724
85-022	NTIS (US Sales Only), PC A04/MF A01		DE86701523	MN -20	11:26725
85-031	NTIS (US Sales Only), PC A03/MF A01		DE86701552	MN -46	11:26611
86-030	*See* NEANDC(J)-119/U		TI86901088	ND -34C	11:26572
JINR-					
8-85-291	NTIS (US Sales Only), PC A02/MF A01		DE86701438	MN -37	11:26123
D-7-84-736	NTIS (US Sales Only), PC A06/MF A01		DE86780376	MN -37	11:26571
E-1-84-703	NTIS (US Sales Only), PC A02/MF A01		DE86701459	MN -34C	11:26593
R-6-85-268	NTIS (US Sales Only), PC A02/MF A01		DE86701429	MN -37	11:26104
R-13-85-215	NTIS (US Sales Only), PC A02/MF A01		DE86701426	MN -37	11:26105
R-13-85-265	NTIS (US Sales Only), PC A02/MF A01		DE86701430	MN -37	11:26106
JPL-PUB-D-					
2582	*See* AD-A-162244/8/XAB				11:25330
JU-PS-					
7	NTIS (US Sales Only), PC A02/MF A01		DE86751574	MN -88	11:25467
Juel-					
1992	NTIS (US Sales Only), PC A03/MF A01		DE86751122	MN -20g	11:26677
1993	NTIS (US Sales Only), PC A03/MF A01		DE86751110	MN -20d	11:26726
1996	NTIS (US Sales Only), PC A08/MF A01		DE86751112	MN -77	11:25587
1997	NTIS (US Sales Only), PC A02/MF A01		DE86751121	MN -20g	11:26678
2002	NTIS (US Sales Only), PC A03/MF A01		DE86751109	MN -20d	11:26727
2011	NTIS (US Sales Only), PC A09/MF A01		DE86751107	MN -80	11:25656
Juel-Spez-					
290	NTIS (US Sales Only), PC A06/MF A01		DE86751106	MN -98	11:25707
326	NTIS (US Sales Only), PC A02/MF A01		DE86751114	MN -77	11:25588
328	NTIS (US Sales Only), PC A11/MF A01; 1		DE86751624	MN -60	11:25511
K/AIS-					
5004	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008844	MN -32	11:26794
5005	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86005491	MN -37	11:26124
K/D-					
5697	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86008926	MN -38	11:25957
K/PS-					
1128	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86008688	MN -71	11:25897
5063	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008897	MN -22	11:25925
KAPL-					
4190	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008785	STD -25	11:25857
KEK-					
84-4	NTIS (US Sales Only), PC A03/MF A01		DE86701641	MN -32	11:26059
84-5	NTIS (US Sales Only), PC A04/MF A01		DE86701642	MN -32	11:26028
84-10	NTIS (US Sales Only), PC A02/MF A01		DE86701637	MN -37	11:26107
KFK-					
3953	NTIS (US Sales Only), PC A03/MF A01		DE86751103	MN -71	11:25385
3958	NTIS (US Sales Only), PC A07/MF A01		DE86751105	MN -20d	11:26728

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3975	NTIS (US Sales Only), PC A03/MF A01		DE86751090	MN -25	11:25858
KFKI-					
1982-51	NTIS (US Sales Only), PC A02/MF A01		DE86900852	MN -34	11:26623
1983-108	NTIS (US Sales Only), PC A02/MF A01		DE86900862	MN -34C	11:26545
1985-60	NTIS (US Sales Only), PC A02/MF A01		DE86701477	MN -34D	11:26530
1985-67	NTIS (US Sales Only), PC A02/MF A01		DE86701626	MN -80	11:25621
1985-69	NTIS (US Sales Only), PC A02/MF A01		DE86701627	MN -80	11:25622
1985-74	NTIS (US Sales Only), PC A02/MF A01		DE86701546	MN -34D	11:26517
1985-77	NTIS (US Sales Only), PC A02/MF A01		DE86701554	MN -34C	11:26594
KURRI-TR-					
255	NTIS (US Sales Only), PC A03/MF A01		DE86701638	MN -70	11:25386
KWU-R-					
917/ 85/ 103	*See* EIR-553		DE86701418	MN -78	11:25672
LA-					
10278-MS	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE86008581	STD -34C	11:26546
10472-MS	NTIS, PC A10/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008324	STD -41	11:25360
10576-MS	NTIS, PC A05/MF A01 (GPO Dep.)	E 1.99:	DE86008575	STD -70B	11:25387
10593-MS	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE86007204	STD -20d	11:26729
10615-M	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE86008574	STD -15	11:25439
10617-MS	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008576	STD -25	11:25880
10620	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86007587	STD -34	11:26541
10626-MS	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE86007575	STD -32	11:26795
10633-MS	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008571	STD -15	11:25440
10649-MS	NTIS, PC A04/MF A01; 1		DE86008566	STD -95d	11:25779
10653-MS	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86008585	STD -20g	11:26679
10657-MS	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE86008582	STD -35	11:26134
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85-3936	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE86003683	MN -4	11:25932
86-215	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86006025	MN -32	11:26796
86-360	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86006039	MN -32	11:26797
86-378	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86006040	MN -45	11:26135
86-503	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86007385	MN -21	11:26730
86-770	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86007368	MN -37	11:25981
86-784	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86007366	MN -13	11:26758
86-820	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86008725	MN -34D	11:26474
86-848	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86008729	MN -20f	11:26680
86-861	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008718	MN -38	11:25958
86-866	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86008719	MN -20f	11:26731
86-867	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86008720	MN -20f	11:26732
86-868	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86008721	MN -20f	11:26733
86-869	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86008722	MN -20f	11:26734
86-889	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008730	MN -4	11:25920
86-922	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86008733	MN -20	11:26735
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86-942	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008739	MN -38	11:25960
86-943	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008740	MN -38	11:25961
86-961	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008742	MN -34B	11:26430
86-983	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86008746	MN -28	11:26060
86-991	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86008747	MN -38	11:25962
86-1005	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86008750	MN -20c	11:26738
86-1027	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008751	MN -38	11:25963
86-1048	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86008753	MN -20c	11:25859
86-1054	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008754	MN -34	11:26553
86-1061	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86008755	MN -25	11:26624
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20065	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008378	MN -34	11:26443
20135	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008374	MN -37	11:26125
20492	NTIS, PC A06/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008398	MN -34D	11:26496
20505	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86007488	MN -95d	11:25780
20581	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008372	MN -28	11:26061
20591	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86005980	MN -11	11:26174
20641	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86005999	MN -34	11:26643
20747	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008397	MN -34D	11:26518
20859	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86008375	MN -34B	11:26412
20914	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86007422	MN -34C	11:26547
21046	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008373	MN -34D	11:26644
21084	NTIS, PC A06/MF A01 (GPO Dep.)	E 1.99:	DE86008399	MN -34D	11:26476
LCC-					
3	*See* AD-A-955006/2/XAB				11:26766
LMSC/F-					
059543	*See* AD-A-161608/5/XAB				11:26386
067835	*See* AD-A-162718/1/XAB				11:26089
LW-					
8507	*See* PB-86-133220/XAB				11:26305
MCR-					
84-1878	NTIS, PC A04/MF A01; 1		DE85902179	MN -38	11:25964
MIRA-					
86/ 01/ XAB	NTIS, PC A$14.00/MF $14.00				11:25830
MKS-					
85-22	*See* STEV-FBA-85-28		DE86751544	MN -90e	11:25321

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NASA/CR-					
174723	*See* DOE/NASA/0310-1	E 1.99:	DE86008611	MN -63	11:25483
175074	*See* DOE/NASA-0563-1		TI86008577	STD -25	11:25854
NBS/SP-					
642-SUPPL-2	*See* PB-86-169109/XAB				11:25274
NBS/TN-					
1216	*See* PB-86-129756/XAB				11:26109
1217	*See* PB-86-167863/XAB				11:25664
NBSIR-					
85/ 3029	*See* PB-86-130234/XAB				11:26126
85/ 3147	*See* PB-86-135274/XAB				11:25791
85/ 3194	*See* PB-86-153848/XAB				11:25794
85/ 3229	*See* PB-86-166600/XAB				11:26245
85/ 3232	*See* PB-86-162211/XAB				11:26612
85/ 3255	*See* PB-86-140514/XAB				11:26226
85/ 3262	*See* PB-86-142098/XAB				11:25792
85/ 3265	*See* PB-86-166626/XAB				11:26246
85/ 3270	*See* PB-86-143906/XAB				11:26519
85/ 3273	*See* PB-86-142148/XAB				11:25793
85/ 3274	*See* PB-86-141942/XAB				11:26231
85-3282	*See* AD-A-163094/6/XAB				11:25697
85/ 3282	*See* PB-86-166667/XAB				11:25698
85/ 3291	*See* PB-86-163821/XAB				11:25795
NEANDC(J)-					
119/ U	JAERI, Tokai-mura, Naka-gun, Ibaraki-Ken 319-11, Japan		TI86901088	ND -34C	11:26572
NHL-					
284007	NTIS (US Sales Only), PC A06/MF A01; 1		DE86751555	MN -11	11:26023
284008	NTIS (US Sales Only), PC A10; 3		DE86751556	MN -11	11:26024
NILU-TR-					
5/ 85	NTIS (US Sales Only), PC A03/MF A01; 1		DE86751550	MN -11	11:26259
NMERDI-					
2-72-4216	NTIS, PC A10/MF A01 - NMERDI Univ. of New Mexico, 457 Washington SE, Albuquerque, NM 87108		DE86901124	MN -92a	11:25329
NP-					
6751454	NTIS (US Sales Only), PC A02/MF A01		DE86751454	MN -97	11:25733
6751458	NTIS (US Sales Only), PC A02/MF A01		DE86751458	MN -4	11:25933
6751460	NTIS (US Sales Only), PC A03/MF A01		DE86751460	MN -95d	11:25781
6751513	NTIS (US Sales Only), PC A04/MF A01; 1		DE86751513	MN -96	11:25801
6751517	NTIS (US Sales Only), PC A13/MF A01; 1		DE86751517	MN -95f	11:25814
6751519	NTIS (US Sales Only), PC A11/MF A01; 1		DE86751519	MN -94c	11:25701
6751520	NTIS (US Sales Only), PC A02/MF A01; 1		DE86751520	MN -11	11:26271
6751521	NTIS (US Sales Only), PC A02/MF A01; 1		DE86751521	MN -98F	11:25738
6751559	NTIS (US Sales Only), PC A02/MF A01; 1		DE86751559	MN -64	11:25503
6751560	NTIS (US Sales Only), PC A02/MF A01; 1		DE86751560	MN -64	11:25504
6751567	NTIS (US Sales Only), PC A13/MF A01; 1		DE86751567	MN -11	11:26318
6751621	NTIS (US Sales Only), PC A02/MF A01; 1		DE86751621	MN -59A	11:25782
6751622	NTIS (US Sales Only), PC A02/MF A01; 1		DE86751622	MN -60	11:25521
6751623	NTIS (US Sales Only), PC A02/MF A01; 1		DE86751623	MN -95d	11:25783
6751625	NTIS (US Sales Only), PC A03/MF A01; 1		DE86751625	MN -59A	11:25784
6751627	NTIS (US Sales Only), PC A06/MF A01; 1		DE86751627	MN -95f	11:25815
6751628	NTIS (US Sales Only), PC A04/MF A01; 1		DE86751628	MN -60	11:25522
6751629	NTIS (US Sales Only), PC A09/MF A01; 1		DE86751629	MN -11	11:25460
6900413	NTIS, PC A07; 3		DE86900413	MN -11	11:25725
6900837	European Organization for Nuclear Research, Geneva, Switzerland		TI86900837	ND -2	11:26029
6900939	NTIS (US Sales Only), PC A16; 3		DE86900939	MN -2	11:26548
6900943	NTIS (US Sales Only), PC A13/MF A01; 1		DE86900943	MN -34C	11:26549
6900946	NTIS (US Sales Only), PC A08/MF A01; 1		DE86900946	MN -2	11:25619
6901060	NTIS (US Sales Only), PC A03/MF A01; 1		DE86901060	MN -98	11:25344
6901066	NTIS (US Sales Only), PC A03/MF A01; 1		DE86901066	MN -98B	11:25345
6901103	SOMED, Box 6282, The University of Alabama, University, 5486		TI86901103	MN -38	11:26004
6901116	NTIS (US Sales Only), PC A03/MF A01; 1		DE86901116	MN -97	11:25542
6901117	NTIS (US Sales Only), PC A03/MF A01; 1		DE86901117	MN -90j	11:25728
6901120	NTIS (US Sales Only), PC A03/MF A01; 1		DE86901120	MN -97	11:25734
6901121	NTIS, PC A03/MF A01;1		DE86901121	MN -97	11:25735
NRCN-					
555	NTIS (US Sales Only), PC A06/MF A01		DE86701520	MN -20	11:25616
NRL-MR-					
5664	*See* AD-A-162418/8/XAB				11:26039
5671	*See* AD-A-162535/9/XAB				11:26136
5694	*See* AD-A-163297/5/XAB				11:25976
5700	*See* AD-A-162357/8/XAB				11:26432
5709	*See* AD-A-163227/2/XAB				11:25975
NSWC-TR-					
85-228	*See* AD-A-163103/5/XAB				11:25700
NUCLEBRAS-CDTN-					
496	NTIS (US Sales Only), PC A02/MF A01		DE86701632	MN -80	11:25663
NUREG-					
0975-Vol.4	NTIS, PC A18/MF A01 - GPO		TI86901170	MN -78	11:25559
1162	NTIS, PC A21/MF A01 - GPO		TI86901238	MN -78	11:25560

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NUREG/CR-				
4207	NTIS PC E16/MF $17.95 - GPO	TI86009171	MN -78	11:25583
4236-Vol.3	NTIS, PC A02/MF A01 - GPO	TI86007202	MN -70	11:25388
4286	NTIS, PC A06/MF A01 - GPO	TI86005186	MN -11	11:25430
4374-Vol.1	NTIS, PC A08/MF A01 - GPO	TI86009020	MN -78	11:25681
4374-Vol.2	NTIS, PC A12/MF A01 - GPO	TI86009021	MN -78	11:25682
4436-Vol.1	NTIS, PC A06/MF A01 - GPO	TI86008834	MN -80	11:25613
4446	NTIS, PC A06/MF A01; 1	TI86900890	MN -2	11:25614
4452	NTIS, PC A04/MF A01 - GPO	TI86007025	MN -78	11:25683
4459	NTIS, PC A07/MF A01 - GPO	TI86009035	MN -78	11:25684
4478	NTIS, PC A05/MF A01 - GPO	TI86006814	MN -32	11:26798
4486	NTIS, PC A07/MF A01 - GPO	TI86009173	MN -78	11:25685
4496	NTIS, PC A05/MF A01 - GPO	TI86901127	MN -11	11:26376
4504	NTIS, PC A03/MF A01 - GPO	TI86008555	MN -70A	11:25431
4545	NTIS, PC A04/MF A01 - GPO	TI86009022	MN -78	11:25686
4555	NTIS, PC A09/MF A01 - GPO	TI86901154	MN -70	11:25389
4565	NTIS, PC A04/MF A01 - GPO	TI86009124	MN -78	11:25687
NVE-E-PUB-				
1/ 85	NTIS (US Sales Only), PC A04/MF A01; 1	DE86751552	MN -60	11:25509
NYU/DAS-				
80-21/ B	*See* PB-86-143484/XAB			11:25455
ON-				
02/ 83	NTIS (US Sales Only), PC A02/MF A01	DE86701469	MN -34D	11:26645
ORNL-				
5842	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE86009205	MN -78	11:25639
6129	NTIS, PC A04/MF A01 (GPO Dep.)	E 1.99: DE86008482	MN -25	11:25846
6183	*See* NUREG/CR-4286	TI86005186	MN -11	11:25430
6196	NTIS, PC A10/MF A01; 1 (GPO Dep.)	E 1.99: DE86007944	MN -41	11:26175
6197	NTIS, PC A07/MF A01; 1 (GPO Dep.)	E 1.99: DE86007945	MN -41	11:26176
6218	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE86006748	STD -32	11:25486
ORNL/CON-				
173	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99: DE86008938	MN -95d	11:25785
177/ V1	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99: DE86007082	MN -98G	11:25786
177/ V2	NTIS, PC A12/MF A01; 1 (GPO Dep.)	E 1.99: DE86007042	MN -98G	11:25787
177/ V3	NTIS, PC A11/MF A01 (GPO Dep.)	E 1.99: DE86007043	MN -98G	11:25788
177/ V4	NTIS, PC A05/MF A01 (GPO Dep.)	E 1.99: DE86007044	MN -98G	11:25789
191	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99: DE86008941	MN -95d	11:25790
ORNL/Sub-				
81-16957/ 1	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99: DE86008952	STD -97b	11:25543
85-37733/ 1	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99: DE86008474	MN -70	11:26377
ORNL/TDMC-				
4	*See* NUREG/CR-4478	TI86006814	MN -32	11:26798
ORNL/TM-				
9386	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99: DE86008947	STD -20	11:26681
9554	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99: DE86008940	MN -96	11:25831
9614-Vol.3	*See* NUREG/CR-4236-Vol.3	TI86007202	MN -70	11:25388
9764	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE86008480	MN -13	11:26563
9770	NTIS, PC A04/MF A01 (GPO Dep.)	E 1.99: DE86007879	MN -88	11:25320
9856	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99: DE86008953	MN -63a	11:25485
9864	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99: DE86007092	MN -32	11:26654
9874	NTIS, PC A04/MF A01 (GPO Dep.)	E 1.99: DE86008471	MN -70	11:25390
9922	NTIS, PC A05/MF A01 (GPO Dep.)	E 1.99: DE86009012	MN -32	11:26799
9955	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE86008477	MN -70	11:25391
9967/ V1	NTIS, PC A05/MF A01; 1	DE86007937	MN -11	11:26281
9983	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99: DE86008565	MN -32	11:26655
ORO-				
5126-254	*See* DOE/ER/05126-254	E 1.99: DE86007349	MN -34D	11:26489
OST/BULL-				
65	*See* PB-86-127081/XAB			11:26367
OU-HET-				
76	NTIS, PC A02/MF A01; 1	DE86900006	MN -34D	11:26531
OUP-				
85-09	NTIS (US Sales Only), PC A03/MF A01	DE86701431	MN -37	11:26108
P/W/GPD-FR-				
18710	*See* AD-A-163052/4/XAB			11:25828
PATENTS-US-	(US: Commissioner of Patents, Washington, D.C. 20231, USA, $1.00 per copy. Government Patent Applications available from NTIS)			
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4,570,703				11:26020
4,571,029				11:25985
4,572,007				11:26252
PB-				
86-111564/ XAB	NTIS, PC A02/MF A01			11:26323
86-112414/ XAB	NTIS, PC A04/MF A01			11:26272
86-114949/ XAB	NTIS, PC A18/MF A01			11:25346
86-114964/ XAB	NTIS, PC A20/MF A01			11:25347
86-115151/ XAB	NTIS, PC A10/MF A01			11:26017
86-115417/ XAB	NTIS MF A01			11:25821
86-115821/ XAB	NTIS, PC A18/MF A01			11:26282

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86-117405/ XAB	NTIS, PC A02/MF A01			11:26177
86-119906/ XAB	NTIS, PC A06/MF A01			11:26260
86-120102/ XAB	NTIS, PC A07/MF A01			11:26295
86-120433/ XAB	NTIS, PC A03/MF A01			11:26296
86-120573/ XAB	NTIS, PC A04/MF A01			11:25965
86-121209/ XAB	NTIS, PC A02/MF A01			11:25289
86-121399/ XAB	NTIS, PC A02/MF A01			11:25469
86-122223/ XAB	NTIS, PC A05/MF E01			11:25860
86-122496/ XAB	NTIS, PC A99/MF A01			11:26297
86-122504/ XAB	NTIS, PC A21/MF A01			11:26298
86-123841/ XAB	NTIS, PC A09/MF A01			11:26178
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86-125143/ XAB	NTIS, PC A09/MF A01			11:25353
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86-127321/ XAB	NTIS, PC A03/MF A01			11:25710
86-127818/ XAB	NTIS, PC A03/MF A01			11:25844
86-128022/ XAB	NTIS, PC A23/MF A01			11:26299
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86-129483/ XAB	NTIS, PC A02/MF A01			11:26181
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86-130218/ XAB	NTIS, PC A05/MF A01			11:26184
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86-131430/ XAB	NTIS, PC A03/MF A01			11:25538
86-131950/ XAB	NTIS, PC A03/MF A01			11:26186
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86-132461/ XAB	NTIS, PC A03/MF A01			11:26301
86-132479/ XAB	NTIS, PC A03/MF A01			11:26302
86-132792/ XAB	NTIS, PC A02/MF A01			11:26190
86-132875/ XAB	NTIS, PC A03/MF A01			11:26303
86-132917/ XAB	NTIS, PC A03/MF A01			11:26304
86-133048/ XAB	NTIS, PC A02/MF A01			11:26191
86-133105/ XAB	NTIS, PC A02/MF A01			11:26192
86-133220/ XAB	NTIS, PC A03/MF A01			11:26305
86-133253/ XAB	NTIS, PC A03/MF A01			11:26306
86-133683/ XAB	NTIS, PC A02/MF A01			11:26193
86-133691/ XAB	NTIS, PC A02/MF A01			11:26194
86-133709/ XAB	NTIS, PC A03/MF A01			11:26195
86-133717/ XAB	NTIS, PC A02/MF A01			11:26196
86-133725/ XAB	NTIS, PC A03/MF A01			11:26197
86-133733/ XAB	NTIS, PC A02/MF A01			11:26198
86-133741/ XAB	NTIS, PC A04/MF A01			11:26199
86-133758/ XAB	NTIS, PC A03/MF A01			11:26200
86-133766/ XAB	NTIS, PC A02/MF A01			11:26201
86-133774/ XAB	NTIS, PC A02/MF A01			11:26202
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86-134020/ XAB	NTIS, PC A05/MF A01			11:26204
86-134988/ XAB	NTIS, PC A07/MF A01			11:26307
86-134996/ XAB	NTIS, PC A12/MF A01			11:26308
86-135175/ XAB	NTIS, PC A04/MF A01			11:26274
86-135274/ XAB	NTIS, PC A09/MF A01			11:25791
86-135381/ XAB	NTIS, PC A05/MF A01			11:25823
86-135431/ XAB	NTIS, PC A02/MF A01			11:26205
86-135449/ XAB	NTIS, PC A03/MF A01			11:26206
86-135613/ XAB	NTIS, PC A02/MF A01			11:26207
86-135621/ XAB	NTIS, PC A02/MF A01			11:26208
86-135639/ XAB	NTIS, PC A02/MF A01			11:26209
86-136165/ XAB	NTIS, PC A05/MF A01			11:25304
86-136421/ XAB	NTIS, PC A03/MF A01			11:25357
86-136504/ XAB	NTIS, PC A10/MF A01			11:26210
86-136520/ XAB	NTIS, PC A06/MF A01			11:26309
86-136546/ XAB	NTIS, PC A08/MF A01			11:26211
86-136645/ XAB	NTIS, PC A02/MF A01			11:26212
86-136652/ XAB	NTIS, PC A02/MF A01			11:26213
86-136660/ XAB	NTIS, PC A02/MF A01			11:25323
86-136710/ XAB	NTIS, PC A02/MF A01			11:26214
86-137155/ XAB	NTIS, PC A07/MF A01			11:25334
86-137163/ XAB	NTIS, PC A11/MF A01			11:26215
86-137403/ XAB	NTIS, PC A11/MF A01			11:26261
86-137445/ XAB	NTIS, PC A02/MF A01			11:26216
86-137452/ XAB	NTIS, PC A02/MF A01			11:26217

Report Number	*Availability Source*	*File Number*	*Distribution Category*	*Abstract Number*
86-137775/ XAB	NTIS, PC A03/MF E01			11:25696
86-137890/ XAB	NTIS, PC A02/MF A01			11:26218
86-137908/ XAB	NTIS, PC A02/MF A01			11:26219
86-138278/ XAB	NTIS, PC A04/MF A01			11:26220
86-138286/ XAB	NTIS, PC A05/MF A01			11:26221
86-138724/ XAB	NTIS, PC A02/MF A01			11:26222
86-138930/ XAB	NTIS, PC A07/MF A01			11:25324
86-138989/ XAB	NTIS, PC A10/MF A01			11:25325
86-139003/ XAB	NTIS, PC A10/MF A01			11:25311
86-139219/ XAB	NTIS, PC A02/MF A01			11:26223
86-139375/ XAB	NTIS, PC A05/MF A01			11:26224
86-139599/ XAB	NTIS, PC A05/MF A01			11:26225
86-140118/ XAB	NTIS, PC A99/MF A01			11:25308
86-140126/ XAB	NTIS, PC A99/MF A01			11:25309
86-140514/ XAB	NTIS, PC A07/MF A01			11:26226
86-140589/ XAB	NTIS, PC A06/MF A01			11:26262
86-140647/ XAB	NTIS, PC A02/MF A01			11:26310
86-140654/ XAB	NTIS, PC A03/MF A01			11:26311
86-140944/ XAB	NTIS, PC A06/MF A01			11:26326
86-141231/ XAB	NTIS, PC A02/MF A01			11:26227
86-141249/ XAB	NTIS, PC A02/MF A01			11:26228
86-141256/ XAB	NTIS, PC A02/MF A01			11:26229
86-141496/ XAB	NTIS, PC A04/MF A01			11:25494
86-141512/ XAB	NTIS, PC A04/MF A01			11:25495
86-141736/ XAB	NTIS MF A01			11:25729
86-141785/ XAB	NTIS, PC A15/MF A01			11:25838
86-141876/ XAB	NTIS, PC A03/MF A01			11:26230
86-141942/ XAB	NTIS, PC A05/MF A01			11:26231
86-141959/ XAB	NTIS, PC A03/MF A01			11:26314
86-142007/ XAB	NTIS, PC A03/MF A01			11:25839
86-142098/ XAB	NTIS, PC A04/MF A01			11:25792
86-142148/ XAB	NTIS, PC A05/MF A01			11:25793
86-142155/ XAB	NTIS, PC A05/MF A01			11:26232
86-142163/ XAB	NTIS, PC A10/MF A01			11:26233
86-142213/ XAB	NTIS, PC A03/MF E01			11:25496
86-142239/ XAB	NTIS, PC A04/MF A01			11:25718
86-142346/ XAB	NTIS, PC A04/MF A01			11:26234
86-143021/ XAB	NTIS, PC A04/MF A01			11:25499
86-143336/ XAB	NTIS, PC A03/MF A01			11:25983
86-143484/ XAB	NTIS, PC A06/MF A01			11:25455
86-143872/ XAB	NTIS, PC A04/MF A01			11:25840
86-143880/ XAB	NTIS, PC A03/MF A01			11:26263
86-143906/ XAB	NTIS, PC A03/MF A01			11:26519
86-143963/ XAB	NTIS, PC A05/MF A01			11:25832
86-144037/ XAB	NTIS, PC A10/MF A01			11:25722
86-144102/ XAB	NTIS, PC A07/MF A01			11:25898
86-144268/ XAB	NTIS, PC A02/MF A01			11:25392
86-144276/ XAB	NTIS, PC A05/MF A01			11:25393
86-144490/ XAB	NTIS, PC A05/MF A01			11:25456
86-144623/ XAB	NTIS, PC A02/MF A01			11:26235
86-144656/ XAB	NTIS, PC A07/MF A01			11:26236
86-144870/ XAB	NTIS, PC A05/MF A01			11:26237
86-144946/ XAB	NTIS, PC A06/MF A01			11:25470
86-145083/ XAB	NTIS, PC A04/MF A01			11:26238
86-145422/ XAB	NTIS, PC A04/MF A01			11:26239
86-145547/ XAB	NTIS, PC A13/MF A01			11:26240
86-145554/ XAB	NTIS, PC A14/MF A01			11:26241
86-145661/ XAB	NTIS, PC A05/MF A01			11:26242
86-145802/ XAB	NTIS, PC A06/MF A01			11:26243
86-146503/ XAB	NTIS, PC A05/MF A01			11:25816
86-146933/ XAB	NTIS, PC A13/MF A01			11:25326
86-147519/ XAB	NTIS, PC A03/MF A01			11:25310
86-147543/ XAB	NTIS, PC A12/MF A01			11:25617
86-147550/ XAB	NTIS, PC A12/MF A01			11:25615
86-147568/ XAB	NTIS, PC A10/MF A01			11:25618
86-147618/ XAB	NTIS, PC A$52.95/MF $52.95			11:25539
86-147626/ XAB	NTIS, PC A99/MF A01			11:25540
86-147899/ XAB	NTIS, PC A03/MF A01			11:26264
86-147923/ XAB	NTIS, PC A03/MF A01			11:26244
86-148632/ XAB	NTIS, PC A08/MF A01			11:25354
86-150380/ XAB	NTIS, PC A06/MF A01			11:25290
86-151107/ XAB	NTIS, PC A06/MF A01			11:25817
86-151560/ XAB	NTIS, PC A99/MF A01			11:25712
86-153848/ XAB	NTIS, PC A02/MF A01			11:25794
86-157427/ XAB	NTIS, PC A03/MF A01			11:25272
86-157435/ XAB	NTIS, PC A03/MF A01			11:25273
86-162211/ XAB	NTIS, PC A13/MF A01			11:26612
86-163821/ XAB	NTIS, PC A07/MF A01			11:25795
86-165446/ XAB	NTIS, PC A99/MF A01			11:26444
86-166600/ XAB	NTIS, PC A03/MF A01			11:26245
86-166626/ XAB	NTIS, PC A04/MF A01			11:26246
86-166667/ XAB	NTIS, PC A06/MF A01			11:25698
86-167863/ XAB	NTIS, PC A09/MF A01			11:25664
86-169109/ XAB	NTIS, PC A99/MF A01			11:25274

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86-901700/ XAB	NTIS				11:25740
86-902000/ XAB	NTIS				11:25471
PFC/JA-					
86-10	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86009045	MN -20f	11:26682
PKT-P-					
84-29	*See* CEGB-TPRD/B-0508/N84		DE86701419	MN -77	11:25667
PNL-					
5519	NTIS, PC A06/MF A01 (GPO Dep.)	E 1.99:	DE86009041	MN -94e	11:25693
5605	NTIS, PC A06/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008788	MN -90d	11:25291
5641-Vol.1	*See* NUREG/CR-4436-Vol.1		TI86008834	MN -80	11:25613
5750-Pt.4	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008875	MN -48	11:26343
5755	*See* NUREG/CR-4504		TI86008555	MN -70A	11:25431
5775	*See* NUREG/CR-4486		TI86009173	MN -78	11:25685
5798-2	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008520	MN -61D	11:25448
5798-3	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008521	MN -61D	11:25449
5804	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE86007972	MN -11	11:26312
PNL-SA-					
11871	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86007783	MN -34A	11:26445
12292	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86007738	MN -90i	11:25327
12528	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86007715	MN -11	11:26365
12589	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86007641	MN -90i	11:25328
13135	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86007727	MN -25	11:25861
13356	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86007732	MN -70	11:25394
13663	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86007736	MN -41	11:26344
13716	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86007734	MN -11	11:26368
PPG-					
913	*See* AD-A-163025/0/XAB				11:26427
PPPL-					
2306	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86007536	STD -20a	11:26683
PPPL-Q-					
42	NTIS, PC A06/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008595	STD -20	11:26739
PRI-					
94	*See* SAIC-85/1922	E 1.99:	DE86008564	STD -20g	11:26684
96	*See* SAIC-86/1521	E 1.99:	DE86008563	STD -20g	11:26685
PSR-					
1422-VOL-8	*See* AD-A-162944/3/XAB				11:26138
1506	*See* AD-A-162603/5/XAB				11:26424
1566	*See* AD-A-163306/4/XAB				11:26429
PWA-					
53/ 85	*See* KFK-3975		DE86751090	MN -25	11:25858
R-					
449	*See* PB-86-147519/XAB				11:25310
RAL-					
85-047	*See* PB-86-130853/XAB				11:25982
85-069	NTIS (US Sales Only), PC A02/MF A01		DE86701539	MN -34D	11:26497
85-072	NTIS (US Sales Only), PC A02/MF A01		DE86701532	MN -34D	11:26498
REPT-					
47U-2247-4	*See* PB-86-136165/XAB				11:25304
113	*See* PB-86-127818/XAB				11:25844
30523	*See* PB-86-157427/XAB				11:25272
30523	*See* PB-86-157435/XAB				11:25273
RFP-					
3935	NTIS, PC A02; 3		DE86007964	MN -41	11:26345
RIFP-					
473	NTIS (US Sales Only), PC A02/MF A01; 1		DE86900880	MN -34C	11:26595
500	NTIS (US Sales Only), PC A02/MF A01; 1		DE86900875	MN -34D	11:26499
RISO-M-					
2433	NTIS (US Sales Only), PC A04/MF A01		DE86701644	MN -2	11:26769
2451-Pt.2	NTIS (US Sales Only), PC A10/MF A01; 1		DE86751514	MN -60	11:25523
2508	NTIS (US Sales Only), PC A02/MF A01		DE86701427	MN -37	11:26110
2511	NTIS (US Sales Only), PC A02/MF A01		DE86701408	MN -80	11:25657
2514	NTIS (US Sales Only), PC A05/MF A01		DE86701645	MN -2	11:26770
2518	NTIS (US Sales Only), PC A02/MF A01		DE86701409	MN -80	11:25688
2519	NTIS (US Sales Only), PC A03/MF A01		DE86701410	MN -80	11:25658
2520	NTIS (US Sales Only), PC A02/MF A01		DE86701411	MN -80	11:25659
2522	NTIS (US Sales Only), PC A02/MF A01		DE86701412	MN -80	11:25660
2525	NTIS (US Sales Only), PC A02/MF A01		DE86701413	MN -80	11:25661
2529	NTIS (US Sales Only), PC A04/MF A01		DE86701646	MN -2	11:26771
2549	NTIS (US Sales Only), PC A03/MF A01		DE86751509	MN -11	11:26267
RR-					
159	*See* PB-86-132388/XAB				11:25348
160	*See* PB-86-132396/XAB				11:25303
RRK-					
84-15	NTIS (US Sales Only), PC A03/MF A01		DE86701528	MN -34B	11:26413
84-16	NTIS (US Sales Only), PC A02/MF A01		DE86701534	MN -34D	11:26500
84-17	NTIS (US Sales Only), PC A02/MF A01		DE86701524	MN -34B	11:26414
84-18	NTIS (US Sales Only), PC A02/MF A01		DE86701533	MN -34D	11:26501
84-19	NTIS (US Sales Only), PC A02/MF A01		DE86701529	MN -34B	11:26415
84-20	NTIS (US Sales Only), PC A02/MF A01		DE86701530	MN -34B	11:26416
SAI-					
84-1176	*See* PB-86-144037/XAB				11:25722
SAIC-					
84/ 1715	*See* AD-A-162163/0/XAB				11:25944
85/ 1922	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE86008564	STD -20g	11:26684

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86/ 1521	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86008563	STD -20g	11:26685
SAND-					
82-2034	NTIS, PC A07/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008873	MN -70	11:26383
82-8254	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE86007780	MN -62c	11:25497
84-1719	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008877	MN -38	11:25305
85-0791/ 2	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008878	MN -63	11:25472
85-0844	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86001125	MN -32	11:26800
85-1243	NTIS, PC A16/MF A01; 1 (GPO Dep.)	E 1.99:	DE86007986	MN -11	11:26145
85-1369	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86007448	STD -71	11:25966
85-1488C	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86007706	MN -13	11:26759
85-1520C	American Institute of Aeronautics and Astronautics, 1290 Ave. of the Americas, New York, NY 10019		TI86005884	ND -38	11:25994
85-1728C	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86003583	MN -25	11:26005
85-1941C	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE86006496	MN -32	11:26809
85-2059	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86006259	MN -15	11:25441
85-2076C	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008776	MN -25	11:25881
85-2086C	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86006234	MN -37	11:26127
85-2234C	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86005888	MN -15	11:25442
85-2236	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86006462	MN -15	11:25443
85-2259	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008874	MN -38	11:26006
85-2324C	NTIS PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86005171	MN -38	11:25995
85-2420C	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86006494	MN -38	11:26007
85-2500	*See* NUREG/CR-4459		TI86009035	MN -78	11:25684
85-2501C	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE86007149	MN -92a	11:26384
85-2502C	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86007703	MN -92a	11:25352
85-2505C	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE86007705	MN -70	11:25395
85-2506C	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008338	MN -92a	11:25358
85-2507C	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86007618	MN -92a	11:25359
85-2670	NTIS, PC A05/MF A01 (GPO Dep.)	E 1.99:	DE86008313	MN -28	11:26049
85-2692C	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008775	MN -34A	11:26446
85-2754C	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86008773	MN -21	11:26740
85-7022	NTIS, PC A12/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008879	MN -63c	11:25473
86-0013C	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86007820	MN -34	11:26447
86-0221C	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86007144	MN -11	11:26247
86-0297C	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008403	MN -37	11:26128
86-0449C	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86007708	MN -11	11:26248
86-0498C	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86007831	MN -37	11:26129
86-0528C	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86007616	MN -38	11:25967
86-8207	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE86008837	MN -62a	11:25487
86-8211	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008793	MN -62a	11:25488
SBI-R-					
171	Statens Byggeforskningsinstitut, P.O. Box 119, DK-2970, Hoersholm, Denmark. Price: Dkr. 59,50			ND -95d	11:25796
SCIENTIFIC-					
1	*See* AD-A-162191/1/XAB				11:26391
SERI/CP-					
211-2875	NTIS, PC A10/MF A01; 1 (GPO Dep.)	E 1.99:	DE86004415	STD -63	11:25474
SFB-					
80/ T-228	NTIS (US Sales Only), PC A02/MF A01		DE86751462	MN -11	11:26283
SGR-					
75	*See* PB-86-115821/XAB				11:26282
SIS-					
1985:8	NTIS (US Sales Only), PC A03/MF A01		DE86701437	MN -37	11:26111
1985:11	NTIS (US Sales Only), PC A03/MF A01		DE86701436	MN -37	11:26112
SLAC-					
290	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008469	STD -34D	11:26477
291	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008145	STD -34D	11:26502
SLAC/AP-					
49	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE86008510	MN -28	11:26050
SLAC-PUB-					
3866	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE86008296	MN -34D	11:26520
SP-RAPP-					
1985-05	NTIS (US Sales Only), PC A03/MF A01		DE86751523	MN -95d	11:25797
SPV-					
71	NTIS (US Sales Only), PC A04/MF A01; 1		DE86751522	MN -95d	11:25798
SSDC-					
29	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE86008185	MN -41	11:26371
30	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE86008184	MN -41	11:26772
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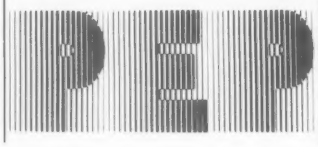

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